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Three Essays in Corporate Finance and Market Microstructure

by

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Abstract

There are two opposing views on the role of regulation of financial markets examined in the academic literature. There is a large body of evidence that suggests that the efficiency of capital markets in North America is in large part due to investors' confidence in the regulatory system. However, the optimal level of regulation is debatable.

We investigate several aspects of the regulation of capital markets by exploring effects of changes in listing requirements on exchanges on the quality of firms undertaking initial public offerings and the quality of firms that choose to go public via a reverse merger mechanism. In addition, we show that additional regulation and/or disclosure of trading activies of informed investors in tender offers may be warranted.

We show that a gradual increase in listing requirements fails to prevent low quality firms from gaining access to public capital markets. Yet, differences in listing rules on uppers and lower tiers of exchanges create a dual listing regime, which allows higher quality firms to differentiate themselves.

We observe migration of most of the reverse merger transactions to the over-the-counter market due to changes in the regulatory environment in 2001. We conclude that regulatory changes had broad negative effects on the reverse mergers market as these pushed reverse merger firms to a less regulated and more opaque marketplace. Separately, we examine the timing of reverse mergers. Our results suggest that two types of reverse mergers follow different timing patterns: private firms go public through merger with financially distressed firms when IPO windows are closed, whereas reverse

takeovers in which the participating public company is a going concern are pro-cyclical to aggregate merger waves.

Finally, we analyze tender offers over the period from 1993 through 2006 and establish a link between non-public information and informed investors' strategic behaviour. Our findings call in question the effectiveness of disclosure mechanisms of trading by informed investors. We also note that uninformed traders can use market microstructure tools to expand their information set, thus increasing the speed of incorporation of new information into stock prices and increasing market efficiency.

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1. Introduction: Three Essays in Corporate Finance and Market Microstructure

My dissertation consists of three essays that examine aspects of initial public offerings and mergers and acquisitions. The first paper in my thesis "Nasdaq Listing Standards and IPO Performance: Is More Regulation Better?" examines changes in listing standards in 1980-2003 on Nasdaq and their impact on the quality of IPO firms. My second paper titled "Timing Issues and Effects of Regulation in the Reverse Mergers Market" investigates market timing issues for a specific type of transactions called reverse takeovers, in which large private firms are acquired by smaller publicly traded firms. It also looks into effects of change in regulatory requirements for reverse merger firms on exchanges. The third paper, "Microstructure Analysis of Informed Trading in Tender Offers" provides evidence that informed investors' behaviour around tender offer announcements can be inferred from the direction and magnitude of medium-size trades (defined as trades of 500-9,999 shares).

The first paper, "Nasdaq Listing Standards and IPO Performance: Is More Regulation Better?" investigates whether listing requirements work as an effective screening mechanism that allows the separation of low and high quality IPO firms in 1980-2003. Our most important empirical result is that a gradual increase in numerical listing standards is not associated with an improvement in the quality of the IPO firms. Second, we document that the introduction of a market valuation-based screen on NASDAQ in 1997 was associated with a substantial decline in

performance of the new listings compared to listings from the previous periods. Separately, we find that the introduction of market tiers with different listing rules allows to separate lower quality firms. Our findings call in question the exchanges' ability to create an effective screening mechanism by changing numerical requirements, but speak in favour of further market segmentation.

The second paper, "Timing Issues and Effects of Regulation in the Reverse Mergers Market," examines timing of reverse mergers and impact of regulatory changes on the reverse mergers market. First, I separate the reverse mergers population into two types of transactions, namely RTOs that facilitate IPOs and RTOs that are motivated by mergers. I show that RTO-IPOs involve a listed firm that is generally in financial distress, and tend to be counter-cyclical to the traditional IPOs. RTO-mergers, in which both target and acquirer are going concerns, are more likely to be pro-cyclical with economic indicators and, in particular, with IPO waves. I also show that regardless of RTO type, post RTO performance is poor, and that NASDAQ's requirement for reverse merger firms to comply with initial listing standards in 2001 rather then maintenance listing rules pushed reverse mergers to the less regulated over-the-counter market. Therefore, reverse mergers with financially distressed firms can no longer be considered an alternative to a traditional IPO.

The third paper, "Microstructure Analysis of Informed Trading in Tender Offers," establishes a link between non-public information and informed

investors' strategic behaviour in tender offers over the period from 1993 through 2006. Prior to a tender offer announcement, we observe leakage of information and stock accumulation by informed traders in friendly takeover deals. Following the announcement, informed traders heavily sell the stock if there is no managerial opposition to the deal. Larger sales of stock by informed traders are assosiated with a higher probability of successful tender offer completion.

2. Nasdaq Listing Standards and IPO Performance: Is More Regulation Better?

2.1 Introduction

There is a large body of academic literature that suggests that the traditional role of exchanges has declined. Macey and O'Hara (2002) argue that listing fees and listing requirements no longer serve their original purpose because the exchanges' reputational role has diminished. Harris (2006, p. 223) asserts that, due to competition and the economics of the exchange industry, "the listing decision is the last traditional function that remains unique to stock exchanges."[1] This view is in sharp contrast with the policymakers' and exchanges' belief that more regulation is better and that an average investor is better protected by tighter rules.

Using a sample of the Initial Public Offerings (IPOs) listing on Nasdaq in 1980-2003, the current paper aims to investigate whether exchanges can prevent poor performing firms from obtaining a listing on the exchange by changing entry and maintenance rules. The major hypothesis we put to test in this paper is the *Gatekeeping Hypothesis*, which predicts that tighter standards should result in higher quality firms listing on the exchange. We expect to observe fewer companies with negative stock returns and negative measures of operating performance as well as smaller percentage of firms that are involuntarily delisted or do not qualify as going concerns after entry barriers are raised[2]. We also test if stricter rules lead to improvements in the average performance of listed firms,

---

[2] Following Ritter (1991), we examine post-IPO performance over a three-year period.

higher liquidity and quicker incorporation of new information in the prices of their stock. They should also increase average stock returns, return on assets and asset turnover as well as liquidity. Tighter listing rules should reduce underpricing of IPOs, spreads, systematic risk in returns of stock of IPO firms, speed of incorporation of new information into prices and volatility of stock prices. Alternatively, less strict listing rules should allow lower quality firms access to the public markets.

Our study tracks the evolution of listing rules on Nasdaq in 1980-2003. We classify changes in listing rules that took place during this period into several categories to obtain a better understanding of their impact on the quality of listing firms. We observe five major types of changes to listing rules on Nasdaq:

i. separation of Nasdaq/NMS (NMS) and Nasdaq SmallCap (SMC) market tiers in 1982-1983

ii. introduction of profitability/operating history rule on Nasdaq/NMS in 1985

iii. introduction of corporate governance requirements on Nasdaq/NMS in 1987[3]

iv. increase in quantitative listing standards on the Nasdaq/NMS market tier in 1989 and in 2001 and on Nasdaq SmallCap tier in 1991

v. introduction of market capitalization rules on both market tiers in 1997.

Our results indicate that higher quality firms list on the upper tier of the exchange and exhibit better performances as evidenced by most measures we test.

[3] Corporate governance requirements were introduced on the Nasdaq SmallCap market tier in 1997, but we are unable to examine their impact because at the same time the exchange authorities introduced three listing alternatives instead of one, including the market capitalization rule.

We do not find consistent evidence to support the thesis that higher numerical standards, including the introduction of a profitability rule in 1985, lead to an improvement in the quality of listing firms or in fewer numbers of poor performers. Only corporate governance rules introduced on the Nasdaq/NMS market segment in 1987 led to a marginal improvement in some characteristics of the IPO firms. At the same time, the relaxation of listing standards resulted in a deterioration of most characteristics of listing firms in 1997-2001.

To our knowledge, the effect of changes in listing rules on the quality of IPO firms over a long period of time has not been studied in the corporate finance literature. Numerous papers track changes following one particular change in securities laws and/or listing rules. Klein and Mohanram (2008) document how the introduction of a market capitalization standard led to a fundamental shift in the riskiness of new securities listed on Nasdaq. Leuz et al (2008) and Marosi and Massoud (2007) find that the enactment of the Sarbanes-Oxley legislation led to an increase in voluntary delistings.

Our analysis proceeds as follows. Discussion of the central hypothesis of our study in the context of the existing literature is undertaken in the next section. Section 2.3 introduces our dataset, section 2.4 presents and discusses the results, and section 2.5 concludes.

2.2. Related Literature and Hypothesis Development

2.2.1 Literature Review and the Gatekeeping Hypothesis

This section discusses in more depth the motivation for our paper and provides a detailed explanation of the central hypothesis of our paper. We also present and explain measures of firm quality which we put to test.

Whether exchanges can perform a screening function and protect investors is a question that is widely discussed in the academic literature. Doidge et al (2004) show an increase in foreign firms' value after cross-listing in U.S. markets, citing listing as one mechanism through which controlling shareholders commit to a lower consumption of the private benefits of control. Simon (1989) demonstrates that investors' forecast errors before 1933 were significantly lower for NYSE-listed companies than for unlisted companies. Harris (2006) quotes NYSE public statements, referring to investors' interest in the reputational function of listing requirements.

At the same time, several studies, including Benston (1973), Bainbridge (2002), Baumol and Malkiel (1993) and Teoh et al (1998), suggest that tighter regulation does not increase market efficiency and the quality of listing firms. Benston (1973) finds that the post-1934 requirement that an income statement disclose gross sales - a figure that some, but not all, companies disclosed prior to 1934 - did not increase the informativeness of stock prices. He concludes that there is substantial evidence that the mandatory disclosure system does not produce information and that "certainly there is doubt that more required disclosure is warranted." Likewise, Bainbridge (2002) argues against the NYSE's

introduction of the requirement to have independent directors on board, arguing that investors concerns would not be adequately taken care of by such a move because "one size does not fit all" and firms should be free to develop unique accountability mechanisms tailored for their special needs. Baumol and Malkiel (1993) review academic studies that compare the efficiency of stock markets in the United States and those in the major foreign countries and conclude that investors in the stocks of U.S. corporations would not benefit from any additional disclosure. Teoh et al (1998) report that firms manage earnings around the IPO, showing that issuers with higher discretionary accruals have poorer stock return performance in the subsequent three years, suggesting that IPO firms can improve their performance as reported in accounting statements around the public offering date. This reinforces the view that formal quantitative requirements set by exchanges are not effective screening mechanisms.

The major question we seek to answer is whether listing rules can be used as a screen to prevent low quality firms from gaining access to public markets. We recognize that exchanges may have an incentive to intentionally set lower entry barriers to facilitate entry due to increased competition in the industry. The New York Stock Exchange and Nasdaq compete for new IPO listings and both exchanges face rivalry on behalf of the Alternative Trading Systems (ATS) over the order flow of public firms. Screens introduced by exchanges perform a dual function of certification of quality and collection of order flow. On the one hand, exchanges need to prevent low quality firms from listing to perform their regulatory function and preserve their reputational capital, but, on the other they

have a mercantile interest in attracting a large flow of orders to increase their profits. Macey and O'Hara (2002, p. 305) examine listing fees and listing requirements and conclude that "being an exchange is a commodity business, and the commodity involved is trading volume." The gravity model predicts that an increase in order flow on one trading floor should increase its attractiveness to prospective listing companies. Coupled with an increase in economies of scale, this creates incentives for exchanges to set lower requirements for listing firms.

Exchanges' conversion from mutual organizations into publicly traded corporations over the last decade created additional incentives for exchanges to act in the interests of their shareholders at the expense of their role as a guardian of public interests. In the highly publicized case Weissman vs. the National Association of Securities Dealers (2007), the court took the side of the private investor and refused protection to the NASD on the basis of absolute immunity afforded to self-regulatory organizations for performing a quasi-governmental function. Steven Weissman, a private investor who lost from investing his funds in Worldcom stock, argued that the exchange's actions in advertising WorldCom in 2000-2002 to woo the firm to remain listed on the Nasdaq rather than moving to the more established New York Stock Exchange were promotional and not regulatory. On September 18, 2007, the United States Court of Appeals for the Eleventh Circuit upheld the lower court's decision. "As a private corporation," the court said, "Nasdaq places advertisements that are patently intended to increase trading volume and, as a result, company profits."[4]

[4] Krause, J. (2007. pp. 20-21).

Our paper examines whether listing rules are an efficient mechanism that allows exchanges to differentiate between low and high quality firms. Our central hypothesis predicts that the introduction of tighter rules leads to higher quality of listed firms, which we measure by stock and operating performances, liquidity and efficiency of market of the stock of listing firms. Higher entry barriers should result in a decline in the percentage of poor performing firms and an improvement in average performances.

2.2.2. Measurements of IPO Firms' Quality

We use a number of variables to measure the quality of listing firms, including variables that proxy for firms' performances and liquidity and market efficiency of the listed firms' stock. Following Ritter (1991), we use a three-year window to examine stock performance of IPO firms. Our operating performance measures include the operating return on assets and asset turnover, which measures efficiency of asset utilization[5]. Both of these measures were used by Jain and Kini (1994) in their study of the operating performance of IPO firms. In addition, we separate IPO firms into two groups. One group includes firms that remain listed and qualify as going concerns, have positive stock returns and operating return on assets, and asset turnover above 100 percent over a three-year period following the IPO. The other group includes corporations that are delisted from Nasdaq and/or do not quality as going concerns three years after the IPO, have negative stock returns and operating return on assets, and asset turnover below 100 percent

[5] We also used deflated operating income by sales as another proxy for operating performance, but the results obtained were qualitatively similar to models that employ an operating profit on assets measure as a dependent variable.

over a three-year period following the IPO. We employ logistic models to track how the number of firms in each of the above groups increases or decreases following each revision in listing rules[6].

Our choice of variables to test changes in liquidity and market efficiency of listed firms' stock is motivated as follows. Underpricing shows by how much the closing price on the first day of trading is above the offer price, or by how much the firm going public is underpriced by underwriters. It represents the amount of money the firm leaves on the table during the public offering. Several studies – Rock (1986), Beatty and Ritter (1986) - have pointed out that undepricing is a result of information asymmetries arising in the process of the Initial Public Offering. If exchanges are able to reduce information asymmetries between investors and the firm by imposing stricter listing criteria, undepricing should decline when listing rules are tightened.

In a similar fashion, a vast body of market microstructure literature, including Bagehot (1971), Glosten and Migrom (1985), Copeland and Galai (1983), Kyle (1985) and Easley and O'Hara (1987), suggests that asymmetry is positively related to spreads. Consequently, bid/ask spreads should decline when information asymmetries are lower. In the context of our study, we will examine whether spreads decline when listing rules become more stringent as information asymmetries should decline if more information about the IPO firms becomes available due to increase in disclosure requirements and as lower quality firms are

[6] Our choice of 100 percent asset turnover is arbitrary. Setting the cut-off value at 200 percent or 300 percent does not affect our conclusions.

prevented from obtaining access to public capital markets due to higher listing rules.

In order to track changes in stock liquidity we construct liquidity ratio, which we calculate as the average number of shares traded on a daily basis in the first year following the IPO divided by the number of publicly held shares. Prior studies, including Welker (1995) and Leuz and Verechia (2000), suggest that increased disclosure reduces information asymmetries and increases market liquidity. Amihud (2002) concludes that illiquidity is associated with small firms stocks, suggesting an explanation for the "small firm effect" over time. We expect liquidity to increase when entry barriers are raised - including requirements for company size and corporate disclosure - and to decrease when these are reversed.

Pastor and Veronesi (2006) suggest that level and volatility of stock prices are positively related to firm-specific uncertainty about average future profitability. If listing standards can reduce such uncertainty over future cash flows, we should expect not only higher returns but lower volatility of IPO stocks. We expect the standard deviation of residual (abnormal) daily stock returns to decrease when listing standards increase.

We estimate the ratio of the variance of five-day returns to daily returns to follow changes in market efficiency measured by the speed at which information is impounded into prices. Previous studies - Lo and MacKinlay (1988), Bessembinder (2003), etc. - have indicated that in a high quality market, price changes will be permanent and transitory volatility low, so the ratio of a long-term return variance to a corresponding short-term variance should be close to one. The

further that variance ratio deviates from the value of one, the lower market quality is. We construct a variance ratio and calculate the absolute value of its deviation from the value of one for each stock. We expect absolute deviation of variance ratio to decline when listing requirements are raised and to increase when exchanges lower listing rules.

The R-squared test is based on previous research findings that include the work of Wurgler (2000), Bushman et al (2003) and Durnev et al (2003), among others. These researchers find that greater idiosyncratic variation corresponds to higher efficiency of the stock market in capital allocation. Earlier, Roll (1988) shows that the extent to which stocks move together depends on the relative shares of firm-level and market-level information capitalized into prices. Our prediction, therefore, is that stocks should exhibit lower R-squared following an increase in listing rules.

2.3. Data and Variables Selection

2.3.1. Sample Description

Our sample includes 5,399 initial public offerings in 1980-2003 listed on Nasdaq or Nasdaq Small Cap. It excludes financial institutions (SIC code 6000-6199), unit investment trusts (SIC code 6726), trusts (SIC codes 6730-6733) and REITs (SIC code 6798). We extract data on IPOs from the Thomson SDC Platinum database and match it with data on new listings from the Center of Research in Security Prices (CRSP) to select IPOs listed on Nasdaq. We obtain data on stock trading from the CRSP and extract operating data from Compustat.

2.3.2. Listing Rules

We create indicator variables to identify listing rules on the upper and lower tiers of Nasdaq during different time periods. Table 2.1 provides a brief description of changes in Nasdaq listing standards in 1980-2003.

We classify all firms listed in February 1983 – December 2003 as National Market System (NMS) or SmallCap (SMC) stocks and assign a value of one to firms listed on the upper tier of the exchange and zero to firms listed on the lower tier. Based on the changes in listing rules described below, we assign indicator variables to represent listing rules on the Nasdaq/NMS tier in 1980-1983 (base level for the whole sample)[7], 1983-1985 (base level for NMS stocks), 1985-1987 (profitability/going concern standards), 1987-1989 (corporate governance rule), 1989-1997 (quantitative requirements), 1997-2001 (market capitalization alternative) and 2001-2003 (quantitative requirements). We assign indicator variables to represent listing standards on the Nasdaq SmallCap market tier in 1983-1991 (base level for SMC firms), 1991-1997 (market capitalization alternative) and 1997-2001 (quantitative requirements).

The first major change in listing rules in our period of study is Nasdaq's separation of National Market System firms in 1983[8]. The Nasdaq SmallCap

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[7] For the purposes of our study, we ignore changes that took place in August 1981, when Nasdaq increased its total assets and capital and surplus requirements. We view this change, not accompanied by the introduction of any new categories of listing requirements, as adjustment for inflation in the late 1970s-early 1980s. In each of the three years – from 1979 through 1981 – the CPI index increased by more than 10 percent. In total, consumer inflation increased by around 60 percent from 1976 through 1981. Inflation was relatively mild after that, with the annual change in prices equal to an average of 3.3 percent in 1982-2003, so we ignored the inflation factor for the rest of the period covered in our sample.

[8] Nasdaq introduced mandatory NMS inclusion criteria in April 1982 and voluntary inclusion criteria in February 1983. It introduced second alternative listing criteria in 1985 and dropped the

Market (SCM) was formed from the regular Nasdaq in August 1991. In order to distinguish between NMS firms and firms listing on the regular Nasdaq prior to 1991, we classify all companies that were eligible to list on the upper tier after the introduction of Nasdaq/NMS voluntary inclusion standards in February 1983 as Nasdaq/NMS firms. This enables us to perform a comparison between firms listed on the upper and lower tiers of Nasdaq not only in 1991-2003, but also in 1983-1991. Our sample includes 4353 firms that listed on the Nasdaq/NMS tier and 671 firms that listed on the SmallCap/Regular tier[9]. The remaining 375 companies in our sample went public in January 1980 - January 1983.

Following separation of the market into two tiers in 1982-1983, we identify five major changes in listing standards within the Nasdaq/NMS tier and two changes in rules within the SmallCap/Regular tier throughout 1980-2003 based on information provided to us by Nasdaq upon request[10]. We classify these changes into four major categories. This classification allows us to relate specific rule revisions with changes in characteristics of listing firms:

I. Profitability rule. In January 1985 Nasdaq developed two voluntary Nasdaq/NMS inclusion criteria instead of one voluntary inclusion alternative. One standard required the listing firm to report a net income of at least $300,000 in the last year or the last two out of three years and the other required it to have an

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mandatory inclusion criteria in 1987. Between April 1982 and February 1983, only 68 companies went public on Nasdaq, so if we use April 1982 as a cut-off line to separate the upper and lower tiers of Nasdaq instead of February 1983, we observe no impact on reported results.

[9] Our numbers are in line with recent Nasdaq statistics. As of December 31, 2005, the Nasdaq National Market included 2,645 companies and the Nasdaq Capital Market, renamed from the Nasdaq SmallCap Market in September 2005, included 563 companies, or 17.5 percent of the total number of companies. In our sample, 14.1 percent of companies going public list on the SmallCap/Regular Market tier.

[10] We assume all responsibility for incorrect interpretation of materials obtained from Nasdaq.

operating history of four years. Both alternatives required a larger public float measured by the number of shares in public hands. The minimum bid requirement was lowered for alternative one and dropped for alternative two. The public float (number of shares) requirement was raised for both alternatives, the market value of public float was set at different levels for the two listing alternatives and the number of market makers was reduced to two from four for both (see table 2.1 for details).

II. Corporate governance rule. In August 1987, Nasdaq required NMS firms to establish an audit committee with a minimum of two independent directors on board, to distribute quarterly reports, to review related party transactions and to solicit proxies for shareholder meetings. The quorum for shareholder meetings was set at fifty percent of common voting stock.

III. Quantitative requirements.

- In February 1989, Nasdaq raised numerical criteria for NMS firms. It replaced rules for total assets and capital&surplus with a requirement to have a higher minimum value of net tangible assets and increased criteria for the market value of public float, number of shares publicly held and number of shareholders. Net income standard was raised for the first listing alternative, whereas the operating history rule was lowered to three years from four years for the second NMS listing alternative.

- In August 1991, Nasdaq changed standards for the SMC segment.

Requirements for total assets and capital&surplus were doubled and rules for the market value of public float and minimum bid price were introduced on the lower market tier for the first time.

- In June 2001, the exchange authorities replaced net tangible assets with the stockholders' equity rule for the two NMS profitability listing standards. They raised the cut-off level of stockholders' equity from $6 million and $18 million to $15 million and $30 million, respectively. We view this as a separate change in listing standards because few firms could afford to list through the market capitalization rule that remained unchanged. Therefore, newcomers had to comply with tighter rules.

IV. Market capitalization rule. In August 1997, Nasdaq introduced a market capitalization standard on both market tiers and increased the number of listing alternatives to three from respectively two for the NMS firms and one for the SMC firms. NMS firms were eligible to list if their market capitalization, total assets or total revenue exceeded $75 million. Two other listing alternatives included requirements for net tangible assets and pretax income or operating history. In addition to a net tangible asset requirement of $4 million, which replaced the total assets rule, SMC firms could list if their market capitalization reached $50 million or if their net income for the last year or the last two out of three years exceeded $750,000. Standards for the number of shares publicly held, market value of public float and number of market makers were increased for both NMS and SMC firms.

2.3.3. Other Variables

We use the following variables to examine differences in the characteristics of IPO firms:

- Three-year raw return[11] - the close price three years after the IPO is compared to the close price on the day of the IPO. The choice of a three-year return is dictated, among other reasons, by the the length of the lock-up period, during which company insiders are prohibited from selling stock they own. The lock-up period usually lasts 180 days, but can be set at three to 24 months.
- Three-year abnormal return – the raw return over the period adjusted for the Nasdaq equally weighted index return[12].
- Return on assets – average of operating income/loss (data 13 from Compustat) divided by total assets (data 6) over a period of three years, or less if data are not available for the whole period.
- Asset turnover – average of sales (data 12 from Compustat) divided by assets (data 6) over a period of three years, or less if data are not available for all years.
- Going concern – this variable attains a value of zero when a firm is in financial distress or involuntarily delisted within three years of the IPO date, and has a value of one otherwise. If a firm merges with another firm or is acquired by another firm we do not consider it as involuntarily delisting.
- Raw return on day one – the close price on the IPO day compared to the offer price to determine the first day return (underpricing).

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[11] Return is set to negative 100 percent if a company goes bankrupt within three years after the IPO. If it is delisted, the last trading price from Datastream is used to calculate returns.

[12] Replacement of equally-weighted Nasdaq index with the equally weighted S&P 500 index does not affect our conclusions .

- Abnormal return on day one – the close price on the IPO day compared to the offer price to determine the first day return and adjusted for Nasdaq equally-weighted index return.
- Spread – ask less bid divided by the closing price 20 business days after the IPO date.
- Liquidity ratio – average of the number of shares traded on a daily basis divided by the number of publicly held shares for the first year after the IPO date. We exclude the first five days of trading because we usually observe a large number of shares changing hands in the first week after the IPO.
- Variance ratio – we construct the ratio of return variances over a longer horizon (five days) and a short horizon (one day) in the first year following the Initial Public Offering:

$$VR = \frac{Var(R_{5\,days})}{5 \times Var(R_{1\,day})}$$

The ratio of a long-term return variance to a short-term return variance should be close to one to reflect the timely incorporation of information into prices. We do not distinguish between over-reaction, when the variance ratio drops below one, and under-reaction, when the variance ratio exceeds a value of one. We calculate an absolute value of the deviation of the variance ratio from the value of one. For the sake of brevity, we will refer to the absolute value of deviation from one as 'variance ratio' consistently throughout this paper. We exclude the first five trading sessions from our calculations.

- The standard deviation of daily residual returns is based on stock returns

minus Nasdaq's equally weighted index returns in year one after the IPO, excluding the first week of trading.

- The R-squared of regression of daily stock returns on returns of Nasdaq equally weighted index in the first year following the IPO date. We exclude the first week of trading to estimate R-squared variables in order to avoid the effects of first day underpricing and abnormal trading activity in the first days after the IPO.

- Assets – we obtain the data on book value of assets immediately following the IPO from the SDC Platinum database or, if missing, from the first annual report filed with the Securities and Exchange Commission. We employ the logarithm of book value of assets in our regression models to control for size effects.

- Underwriter ranking – rankings for lead underwriters from Jay Ritter's IPO database file IPO Underwriter Reputation Rankings (1980-2004).

- Venture capital – an indicator variable with a value of one if the IPO was backed up by venture capital firm(s), and zero otherwise.

- Working capital – this indicator variable attains a value of one if the purpose of the share placement is to increase working capital, and zero otherwise.

- Debt – the indicator variable attains a value of one if the purpose of the share placement is to repay debt or refinance, and zero otherwise. Information on use of proceeds is obtained from the SDC Platinum database.

- Hotmarket – a dummy variable that equals one when the IPO market is hot, and zero otherwise. We employ essentially the same methodology that Ibbotson and Jaffe (1975) adopted and that was used by Ritter (1984). We calculate a

monthly average of abnormal first day returns, estimate the median for the monthly series data and then assign a value of one to all months with the average value of returns above the median, and zero otherwise.

- Market return – return of the equally weighted Nasdaq index for the matching time period.

Descriptive statistics for all performance/liquidity/market efficiency variables are reported in table 2.2. We set the values of the smallest and largest five percent of the operating performance variables – return on assets and asset turnover – as equal to the value of the observation at the respective five percent tail[13]. We will consistently use winsorized data for all measures of operating performance throughout this paper.

2.4. Results

This section investigates how firm characteristics are affected by changes in listing standards. First we examine the effects of the separation of the Nasdaq market into upper and lower tiers in 1982-1983. We then proceed to investigate changes of listing rules by category (type of change), including the introduction of a profitability rule for NMS firms in 1985 and corporate governance requirements for NMS firms in 1987, an increase in quantitative requirements for NMS firms in 1989 and 2001 and SMC firms in 1991, and the introduction of a market capitalization rule in 1997 on both market tiers.

[13] Examples of winsorizing data, including accounting data, in the financial literature, include Jegadeesh and Livnat (2006), Pontiff and Woodgate (2008) and Sufi (2009).

A quick perusal of descriptive statistics for each performance/liquidity/market efficiency measure in table 2.3 reveals that SMC firms are lower in quality compared to firms listed on the upper tier of Nasdaq. Average performance of firms listed on the NMS tier is better as measured by raw and abnormal three-year returns, return on assets and asset turnover. In addition, firms listed on the NMS tier have higher survival rate. Means for four out of six liquidity and market efficiency measures, including lower average spreads, lower average residual standard deviation, lower average variance ratio and higher liquidity, suggest that upper tier firms have higher quality. Two measures – underpricing and share of systematic risk in stock returns – point in the opposite direction, but this is due to sharp deterioration of firms' quality in the 1997-2001 period. In addition, we observe deterioration of most metrics for NMS firms in 1989-1997 and for both categories of firms in 1997-2003. Results are confirmed by regression models for the 1980-2003 period as reported in table 2.4 and models for the period of 1983-2003 as reported in table 2.5, during which Nasdaq preserved a two-tier structure[14]. A more detailed analysis follows.

2.4.1. Separation into Two Tiers (1982-1983)

The gatekeeping hypothesis asserts that firm quality should improve when listing standards are raised and deteriorate when these standards are relaxed. Since numerical standards are set higher for NMS firms and corporate governance

[14] Our robustness checks include the use of the logarithm of book value of assets minus the value of intangible assets to control for size effects, industry dummies as additional control variables and value-weighted instead of equally-weighted index. Our conclusions remain the same. Statistical output is available upon request.

requirements were first introduced on the upper tier, the separation of the Nasdaq market into two tiers provides an excellent testing ground to examine if tighter rules lead to improvement in quality of listed firms. Nasdaq National Market System (NMS) firms outperform their Nasdaq SmallCap (SMC) peers based on three-year raw returns, operating return on assets, asset turnover and the number of firms that remain listed and qualify as going concerns three years after the IPO (see last line - 1983-2003 - in each panel for lower and upper tier firms in table 2.3)[15]. Comparison of percentages of firms with positive three-year returns, return on assets and asset turnover above 100 percent reveals the same pattern. Not all differences are statistically significant, but most are (results of t-test for means, Wilcoxon tests for medians and tests for proportions are omitted for parsimony, but are available upon request).

A comparison of measures of liquidity and market efficiency leads to less uniform conclusions. We expect upper tier stocks to be subject to smaller underpricing (first day returns), smaller spreads one month after the IPO, higher liquidity, a smaller variance ratio, a standard deviation of residual returns and R-squared of daily returns on Nasdaq equally weighted index returns in the first year after the IPO in line with earlier discussion in paragraph 2.2.2. Results are as expected for spreads, liquidity, variance ratio and standard deviation of residual returns (see table 2.3). Contrary to our expectations, NMS stocks have a larger share of systematic risk in total returns as measured by larger average R-squared in regressions of stock on index returns. Also, NMS stocks are subject to more

[15] Note that aggregate statistics for NMS firms are for the 1983-2003 period and thus exclude January 1980-January 1983 IPOs, which we do not separate into an upper or lower tier. Nasdaq introduced a two-tier system in 1982-1983.

underpricing. These results are in large part attributable to the inclusion of the bubble period of 1997-2000 in our sample. If we exclude stocks that listed under the 1997-2001 listing rules, first day returns on the NMS tier drop below 13 percent and below those of SMC firms.

In the multivariate regression results reported in table 2.5, the NMS dummy variable assumes the expected sign in all models except in the model with variance ratio as dependent variable, in which it is suppressed by the size variable. Our result is robust to the use of book value of assets less value of intangibles (results available upon request). We conclude that, on balance, upper tier firms are better performers and the market for their stock is more liquid and more efficient.

In passing, we will mention that we find no evidence that the lower tier is more regulated than the upper tier. One would expect this to be the case because information asymmetries are much larger for stocks of smaller companies. However, empirical evidence points to the contrary – in 1983-2003, Nasdaq implemented five major revisions of listing rules on the Nasdaq/NMS tier, but only two on the SmallCap/Regular tier. In 1997 Nasdaq lowered listing requirements on both tiers of the exchange, but at all other times it increased its numerical requirements or added new ones.

2.4.2 Profitability Rule (NMS, 1985)

A comparison of descriptive statistics for 1983-1985 and 1985-1987 does not reveal a consistent pattern in changes in performance of NMS firms following the

introduction of new rules in January 1985 (table 2.3). Multivariate regressions reported in table 2.6 show that firms that went public on Nasdaq in January 1985 - August 1987 provided lower operating asset returns, and that both the number of firms with an asset turnover below 100 percent and the percentage of delisted or financially distressed firms increased. Liquidity of stock improved, but its volatility and systematic risk component in total returns increased as well. We conclude that the introduction of profitability requirements, an additional listing alternative and an increase in public float did not lead to improvements in the quality of IPO firms.

2.4.3. Corporate Governance Rule (NMS, 1987)

Descriptive statistics reveal higher three-year raw and abnormal returns measured by means, but not medians, in a subsample of 1987-1989 IPOs compared to the 1985-1987 period (table 2.3), during which previous set of listing rules was in place. Operating data and survival statistics practically do not change in 1987-1989 compared to 1983-1985. First-day returns decline, liquidity increases and so does the share of the systematic risk in daily stock returns.

In regression and logistic models (table 2.7) the indicator variable that represents the 1987-1989 listing rules assumes a positive sign in models that predict a three-year survival rate and explain changes in liquidity. In all other models, the variable is not statistically different from zero. We conclude that the introduction of corporate governance requirements led to marginal improvements on the NMS market tier.

2.4.4. Numerical Standards Increase (NMS-1989, SMC-1991, NMS-2001)

NMS firms exhibited lower index-adjusted stock returns and decreased operating performance following a change in Nasdaq rules in 1989. On the SMC tier we observe decline in the percentage of high performing firms measured by all variables including stock returns, operating performance and survival rates after 1991. Changes in liquidity and market efficiency measures fail to reveal a consistent trend on both the upper and the lower tiers (see table 2.3).

The regression models reveal a similar pattern for both NMS and SMC firms (see table 2.8 for the NMS standards change in 1989 and table 2.11 for the SMC standards change in 1991). The listing standards indicator variable takes on a negative sign or is not significantly different from zero in models which explain firms' performance. Out of models with six liquidity and market efficiency measures, only in two - with liquidity and share or systematic risk as dependent variables – do the listing standards variables assume the expected sign in regressions which use data on firms in the two tiers.

The change in listing rules for NMS firms in 2001 had a positive effect, as evidenced by the sign of the listing variable dummy in table 2.10, which compares the quality of firms listing in 2001-2003 with that of firms listing in 1997-2001. Descriptive statistics (table 2.3) also show that the quality of firms listing in 2001-2003 is higher than the quality of firms listing in 1997-2001. However, firms listing after 2001 do not exhibit better performances than those than listed prior to 1989. A comparison of firms listing in 2001-2003 with those that went public in 1997-2001 helps us underscore the detrimental effects of the

introduction of the market capitalization standard in 1997 rather than the impact of an increase in quantitative requirements for two out of the three NMS listing alternatives[16].

Results from regression models reported in table 2.4 and table 2.5 show that the coefficient that represents NMS listing rules in 2001-2003 is negative, although not as negative as coefficients for the 1989-1997 and 1997-2001 periods. We conclude that an increase in performance, lower underpricing, volatility and a portion of systematic risk in stock returns after 2001 is relative to the two previous periods only. We do not attribute this improvement to tighter listing rules. First, fewer firms were eligible to list under the market capitalization standard after the Nasdaq market crash in 2000. Secondly, companies that listed in 2001-2003 did so outside the IPO "window," which would explain why firms' performance improved. Ritter (1991) documents that companies going public in high-volume years fare the worst among all IPOs and that relative performance of IPO firms in low-volume years is better, so the improvement in performance in 2001-2003 could at least in part be attributed to IPO cycle effects.

2.4.5. Market Capitalization Rule (NMS-1997, SMC-1997)

The introduction of the market capitalization rule on the NMS tier led to a sharp deterioration in the quality of listed firms. The percentage of firms with negative stock returns, negative operating performance and firms in distress or delisted three years after the IPO is the highest in 1997-2001 compared to all

[16] The market capitalization rule introduced in 1997 was not affected by changes implemented in 2001.

other time periods. In the multivariate models reported in table 2.9 the listing variable assumes a negative sign or not different from zero in all performance measures. It should be noted that we compare NMS firms listed in 1997-2001 with those listed in 1989-1997, when performances were also lower than in other periods. Models that explain the performances reported in table 2.4 and table 2.5 reveal that the listing dummy assumes its lowest value in 1997-2001, except in one logistic regression in table 2.4.

First day returns increase sharply on the upper tier of Nasdaq during the bubble period[17], reflecting large information asymmetries in the market for high tech firms. Liquidity improves, leading to a decline in spreads, but we do not view this as a sign of higher quality in the IPO firms given the characteristics of the market as a whole during that period of time. Liquidity increases in the first phase of the bubble cycle, but this can not be interpreted as an increase in the market quality because liquidity increases due to speculative and noise trading. Large values of the kurtosis measure coupled with negative stock returns, large first day underpricing and volatility in the first year after the IPO confirm our conclusion that the quality of listing firms deteriorated sharply in 1997-2001.

We observe similar changes in Nasdaq SMC market tier firm performances when measured by descriptive statistics. However, regressions show that the listing variables dummy attains a positive sign in two logistic models and is not significant from zero in other performance models (table 2.12). We attribute this result to large negative returns and the significance of the market return variable,

[17] The height of the bubble, as measured by the Nasdaq Composite Index, was at the end of February 2000, at which time the index reached a value of almost 4,700.

which explains a large share of the decline in performances. When the market return variable is excluded from our specifications, the listing variable attains the expected negative value. We cannot conclude that small capitalization firms' performance improved after 1997. Liquidity and market efficiency of SmallCap stocks improved as measured by five metrics out of six (table 2.12). These results are robust to the exclusion of the market return variable.

The number of firms listing on the lower marker tier dropped significantly after 1997, which we attribute to the ease of obtaining a listing on the NMS market in that period. Only 73 firms listed on the SmallCap market tier in 1997-2001. We therefore formulate our conclusions based primarily on changes observed in the NMS market. A loosening of the listing rules – the introduction of a market capitalization standard (alternative 3 for listing on the Nasdaq/NMS market tier) – resulted in lower performances, larger information asymmetries and a larger share of systematic risk in total stock returns. A decline in the quality of IPO firms following the relaxation of listing rules in 1997 discussed in this paragraph lends support to the gatekeeping hypothesis, which we formulated at the beginning of our study.

In summary, we conclude that separation of the market into upper and lower tiers in 1982-1983 and relaxation of the listing rules in 1997 confirm our thesis that tighter listing rules improve the quality of listing firms whereas looser listing standards work in the opposite direction. However, an increase in numerical standards on the NMS tier in 1985, 1987 and 1989 and on the SMC tier in 1991 failed to increase the quality of IPO firms.

2.5. Conclusion

The principal role of listing requirements is to ensure a minimum level of quality of firms going public and trading on stock exchanges; exchanges perform a screening function and act as intermediaries between IPO firms and investors. By changing listing rules, exchanges can determine which types of firms can list on its trading floor(s). Despite the large body of literature on exchanges and research on the effects of a one-time revision in listing rules and securities laws, there is, to the best of our knowledge, no study that examines the impact of changes in listing standards over a long period of time.

The key findings of our paper can be summarized as follows. We find partial confirmation for the gatekeeping hypothesis, which predicts that tighter listing rules result in an improvement in the quality of listing firms. Different listing standards for various market tiers result in a separating equilibrium, in which high quality firms distinguish themselves from low quality firms. The introduction of corporate governance rules led to minor improvements in the quality of IPO firms. Permission to list high-risk firms under the market capitalization standard resulted in a sharp deterioration in firm characteristics. However, our results also show that an increase in quantitative rules has a limited effect on the performance of the listing firms, market quality and liquidity.

One possible explanation for the ineffectiveness of numerical listing rules is that exchanges apply them with discretion. Aggarwal and Angel (1997) find that 10 out of the 59 Nasdaq firms that switched to the NYSE during 1995 failed to meet all the quantitative listing requirements, which therefore should be viewed as

guidelines rather than rigid criteria. Our article provides empirical support to the suggestion to look beyond quantitative rules and give more weight to qualitative issues including business plans, quality of management and corporate governance in listing decisions (see Macey and O'Hara, 2002). However, it is not clear how such criteria could be implemented consistently, given the leeway exchanges give themselves in applying quantitative listing standards. Exchanges may have a preference for numerical rules because these provide formal selection criteria and are more suited to prevention of abuse and 'favoritism' by exchange managers.

Our conclusion that firms listing on Nasdaq's upper tier are of higher quality than firms listing on the exchange's lower tier speaks in favour of further market segmentation and is in line with Harris' (2006) suggestion to create separate trading floors on one exchange as one possible solution to the conflict of interest resulting from the exchanges' willingness to sacrifice reputational capital in order to exploit market inefficiencies for their shareholders' benefit.

Nasdaq preserved its two-tier structure up until February 2006, when it introduced a Nasdaq Global Select Market; a third trading tier with "the highest initial listing standards in the world"[18] according to the exchange itself, but this event occurred outside the time period that we study. Currently, Nasdaq includes three market tiers: the Nasdaq Global Select Market, the Nasdaq Global Market (formerly National Market) and the Nasdaq Capital Market (formerly SmallCap). In March 2006, Pink Sheets, LLC introduced OTCQX, a new tiered listing service that offers a premier trading, quotation and disclosure venue for any over-the-

[18] NASDAQ Creates New Market Tier with Highest Listing Standards in the World, 2006. Press release.

counter (OTC) domestic or foreign stocks that provide regular financial disclosure. The OTCQX trading platform incorporates two tiers: PremierQX, which has a higher inclusion criteria, and PrimeQX for smaller-sized companies. Based on results reported in this paper, we anticipate statistically significant differences in the performances of firms in different market segments[19].

[19]We are aware of Aggarwal and Angel (1999) article describing the rise and collapse of the Amex Emerging Company Marketplace. However, this failure, as noted by Aggarwal and Angel, was not due just to adverse selection problems alone, but was also a result of the organizational structure of the exchange and internal conflicts of interest.

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Table 2.1.: Listing Rules on Nasdaq in 1980-1983

The table describes changes in listing rules on Nasdaq, including the Nasdaq National Market System (NMS) and the Nasdaq Small Cap (SMC) market tier. Data are based on 1980-1983.

Tier	Dates	Description of listing requirements changes
n.a.	Jan.1, 1980-Jan.31,1983	Entry listing standards as of Jan. 1, 1980 include the following rules: total assets of $1 million, capital&surplus of $500,000, 100,000 shares in public hands, 300 shareholders and 2 market makers. Change in listing standards in August 1981 treated as inflationary adjustment as only two quantitative requirements – total assets and capital & surplus – were increased to $2 million and $1 million, respectively, with no other changes following. Maintenance standards included the same categories, but lower quantitative requirements were established
NMS	Feb.1,1983-Jan.21,1985	Nasdaq/NMS voluntary inclusion criteria become effective Feb.1, 1983. Requirements include: net tangible assets of $2 million, capital&surplus of $1 million, minimum bid price of $5, average trading volume of 100,000 shares per month over six months, public float of 250,000 shares, 300 shareholders and 4 market makers
NMS	Jan.22,1985-Aug. 3,1987	Nasdaq introduced two voluntary listing criteria instead of one. The first listing alternative included the requirement to report net income of $300,000 in last fiscal year or two of the last three fiscal years, have capital&surplus of $1 million, minimum bid price of $3, market value of public float of $2 million, public float of 350,000 shares and 2 market makers. The second alternative required the listing firm to have an operating history of 4 years, have capital&surplus of $8 million, a market value of public float of $8 million, public float of 800,000 shares and 2 market makers. The requirement to have total assets of $2 million for both criteria for voluntary inclusion and rules for mandatory inclusion were unchanged
NMS	Aug. 4, 1987 - Feb. 6, 1989	A corporate governance requirement was added to listing entry and maintenance criteria. Companies listing on NMS are required to distribute quarterly reports, maintain a minimum of two independent directors on the board, establish an audit committee consisting primarily of independent directors, solicit proxies for all shareholder meetings, review related party transactions and maintain a quorum of at least 50 percent of outstanding common voting stock for any shareholder meetings
NMS	Feb.7,1989-Aug.21,1997	The mandatory inclusion rule was dropped. Companies listing under the first alternative must have net tangible assets of $4 million (instead of total assets of $2 million previously), net income of $400,000, pretax income of $750,000, minimum bid price of $5, market value of public float of $3 million, public float of 500,000 shares and a number of shareholders of either 400 or 800 depending on the number of shares publicly held. Companies listing under the second alternative were required to report net tangible assets of $12 million, have an operating history of 3 years, a market value of public float of $15 million, a public float of 1,000,000 shares and 400 shareholders. Maintenance standards were revised
NMS	Aug.22, 1997-Jun. 28, 2001	Quantitative requirements increased for alternatives 1 and 2, including a minimum cut-off level for net tangible assets to $6 million and $18 million respectively, and a pretax income of $1 million for alternative 1. Number of market makers was increased to 3 from 2 for each alternative, whereas public float, market value of public float and minimum bid price were set at different levels. The operating history requirement for alternative 2 was lowered to two years from three years and number of shareholders was set at 400 for the alternative one, replacing the scale from 400 to 800 depending on the number of shares publicly held. A market capitalization standard was introduced, allowing firms to list based on either market capitalization, total assets or total revenue of $75 million. The market value of public float is set higher for the market capitalization alternative and the number of market makers is set at four compared to three for alternatives one and two
NMS	June 29, 2001-Dec.31,2003*	Stockholders' equity requirement increased for alternatives one and two to $15 million and $30 million, respectively. The market capitalization rule was unchanged

*We do not consider that the following changes should be considered a major revision in listing rules on the NMS market tier: i) pretax income redefined as income from continuing operations before income taxes for alternative one as of February 6, 2002; ii) market capitalization was redefined as market value of listed securities as of June 1, 2002

Table 2.1 (continued)

S.Cap/ Regular	Feb. 1, 1983- Aug. 29, 1991	Regular Nasdaq standards remained unchanged from August 1981 up until August 1991. Categories for which quantitative standards were set included total assets ($2 million), capital & surplus ($1 milllion), public float (100,000 shares), number of shareholders (300) and number of market makers (2). Maintenance standards included the same categories, but lower quantitative requirements were established
S.Cap/ Regular	Aug. 30, 1991- Aug. 21, 1997	The Nasdaq SmallCap Market was formed from the regular Nasdaq. Requirements for total assets and capital&surplus were increased to $4 million and $2 million, respectively. Minimum bid price of $3 and market value of public float of $1 million were added as requirements. Rules for number of shares in public hands (100,000), number of shareholders (300) and number of market makers (2) remained unchanged
S.Cap/ Regular	Aug. 22, 1997- Dec. 31, 2003**	A market capitalization standard allowed companies to list based on criteria of their choice, replacing the old set of rules. Companies may list if they report net tangible assets of $4 million, net income in the last year or two of the last three fiscal years of $750,000 or market capitalization of $50 million. Nasdaq raised requirements for minimum bid price, market value of public float, public float and introduced a one-year operating history rule for firms not listing under the market capitalization standard. Corporate governance requirements previously in force for the NMS market tier were extended to SmallCap stocks. Maintenance standards were changed along the same lines as entry rules

Table 2.2.: Descriptive Statistics for Various Characteristics of Initial Public Offerings on Nasdaq in 1980-2003

The table reports the mean, median, standard deviation, minimum and maximum values, variance, skewness and kurtosis for various IPO performance characteristics. Description of variables is in section 3. Abnormal stock returns are adjusted for returns of the Nasdaq equally weighted index. Operating performance measures - return on assets and asset turnover - are winsorized at a 5 percent level to mitigate the influence of outliers. Data for liquidity - number of shares traded divided by number of shares publicly held, deviation of variance ratio from one, standard deviation of residual returns and R-squared of regressions of daily stock returns on Nasdaq equally-weighted index variable are based on data in the first year after the Initial Public Offering. Variance ratio equals 5-day stock return variances over one-day variances multiplied by five. The data are based on 1980-2003.

	Number of observations	Mean	Median	Standard deviation	Minimum	Maximum	Variance	Skewness	Kurtosis
Three-year raw return	5399	0.18	-0.34	2.01	-1.00	35.90	4.05	8	100
Three-year abnormal return	5399	-1.08	-1.22	2.15	34.55	-6.03	4.63	6	70
Return on assets	4816	-0.31	0.02	0.78	-2.45	0.45	0.60	-2	1
Asset turnover	4815	2.84	2.52	2.05	0.18	7.63	4.22	1	0
First-day raw return	5399	2.55	2.18	2.11	0.18	7.63	4.45	1	0
First-day abnormal return	5399	0.22	0.07	0.46	-0.38	8.29	0.22	6	52
Spread one month after IPO date	4295	0.03	0.03	0.03	0.00	0.40	0.001	4	37
Liquidity ratio (shares traded/publicly held shares)	5163	0.70	0.52	0.75	0.01	24.79	0.57	9	224
Variance ratio (deviation from one)	5399	0.24	0.20	0.19	0.00	1.75	0.04	1	1
Standard deviation of residual returns	5399	0.05	0.04	0.02	0.01	0.38	0.0005	2	14
R-squared of regressions of stock returns on market returns	5399	0.07	0.05	0.07	0.00	0.50	0.0051	2	3

Table 2.3: Selected Statistics for Initial Public Offerings Listed on Nasdaq in 1980-2003.
The table presents selected descriptive statistics, including mean, median, variance, skewness, kurtosis for various characteristics of firms listed on Nasdaq/Nasdaq National Market System and Nasdaq Small Cap market tiers during different listing regimes. Variables include three-year raw and abnormal returns, return on assets, asset turnover, proportion of firms that qualify as going concerns three years after the IPO, first day returns (underpricing), spreads one month after the IPO date, liquidity defined as number of shares traded divided by number of publicly outstanding shares, deviation of variance ratio from value of one, standard deviation of residual returns and R-squared of regression of daily stock returns on the Nasdaq equally weighted index return in the first year after the IPO. Percentage of observations with positive values is reported for stock returns and operating performance measures. Operating performance measures - return on assets and asset turnover - are winsorized at a 5 percent level to mitigate the influence of outliers. Spread is calculated one month after the Initial Public Offering. Data for liquidity - number of shares traded divided by number of shares publicly held, deviation of variance ratio from one, standard deviation of residual returns and R-squared of regressions of daily stock returns on the Nasdaq equally-weighted index are based on data in the first year after the Initial Public Offering. Variance ratio equals five-day stock return variances over one-day variances multiplied by five. The table reports statistics for absolute deviation of variance ratio from the value of one. Results are reported separately for each market tier and for different time periods corresponding to various listing regimes. Data are based on 1980-2003. Aggregate statistics for the Nasdaq National Market System are based on 1983-2003.

Selected statistics for 3-year raw returns

	N	Mean	Median	Percentage with positive value	Variance	Skewness	Kurtosis
Data for Small Cap market tier stocks							
1983-1991	308	-26%	-59%	21%	1.0	4	23
1991-1997	290	-13%	-66%	20%	3.4	7	65
1997-2003	73	-56%	-83%	8%	0.7	4	19
1983-2003	671	-24%	-66%	19%	2.0	7	83
Data for Nasdaq/Nasdaq National Market System market tier stocks							
1980-1983	375	26%	-22%	41%	3.2	7	77
1983-1985	445	21%	-16%	42%	1.8	3	9
1985-1987	484	18%	-13%	42%	1.5	3	12
1987-1989	129	37%	-13%	43%	2.7	4	18
1989-1997	2,203	46%	-13%	44%	5.5	7	78
1997-2001	997	-22%	-80%	18%	4.9	10	131
2001-2003	95	37%	10%	60%	1.1	1	1
1983-2003	4,353	24%	-29%	38%	4.4	8	98

Selected statistics for 3-year abnormal returns

	N	Mean	Median	Percentage with positive value	Variance	Skewness	Kurtosis
Data for Small Cap market tier stocks							
1983-1991	308	-63%	-84%	15%	1.2	2	18
1991-1997	290	-181%	-211%	6%	3.2	6	60
1997-2003	73	-152%	-173%	4%	0.8	3	13
1983-2003	671	-124%	-124%	10%	2.4	4	44
Data for Nasdaq/Nasdaq National Market System market tier stocks							
1980-1983	375	-21%	-65%	28%	3.0	7	76
1983-1985	445	-1%	-38%	35%	1.8	3	9
1985-1987	484	-17%	-49%	29%	1.4	3	11
1987-1989	129	-4%	-46%	34%	2.5	3	19
1989-1997	2,203	-171%	-206%	11%	6.1	6	62
1997-2001	997	-98%	-137%	10%	4.6	10	135
2001-2003	95	-69%	-87%	26%	1.1	0	0
1983-2003	4,353	-113%	-131%	16%	5.1	6	70

Table 2.3 (continued)

Selected statistics for return on assets

	N	Mean	Median	Percentage with positive value	Variance	Skewness	Kurtosis
Data for Small Cap market tier stocks							
1983-1991	225	-70%	-39%	28%	0.8	-1	-1
1991-1997	254	-105%	-80%	16%	0.9	0	-1
1997-2003	66	-88%	-75%	21%	0.9	0	-1
1983-2003	545	-89%	-59%	21%	0.9	-1	-1
Data for Nasdaq/Nasdaq National Market System market tier stocks							
1980-1983	294	6%	12%	64%	0.3	-2	5
1983-1985	371	-1%	15%	70%	0.3	-2	7
1985-1987	412	5%	15%	75%	0.2	-3	13
1987-1989	115	10%	16%	78%	0.1	-2	6
1989-1997	2,037	-15%	8%	61%	0.4	-2	4
1997-2001	950	-72%	-47%	25%	0.8	-1	-1
2001-2003	92	-22%	4%	52%	0.5	-2	2
1983-2003	4,271	-23%	5%	56%	0.5	-2	2

Selected statistics for asset turnover

	N	Mean	Median	Percentage with positive value	Variance	Skewness	Kurtosis
Data for Small Cap market tier stocks							
1983-1991	224	282%	264%	80%	3.9	1	0
1991-1997	254	261%	213%	71%	4.4	1	0
1997-2003	66	251%	188%	67%	4.4	1	0
1983-2003	544	268%	241%	74%	4.2	1	0
Data for Nasdaq/Nasdaq National Market System market tier stocks							
1980-1983	294	291%	272%	85%	3.3	1	0
1983-1985	371	332%	310%	91%	3.6	1	0
1985-1987	412	372%	336%	90%	4.4	0	1
1987-1989	115	368%	331%	85%	4.7	0	-1
1989-1997	2,037	301%	275%	81%	4.2	1	0
1997-2001	950	185%	135%	61%	3.0	2	2
2001-2003	92	284%	227%	78%	4.8	1	0
1983-2003	3,977	285%	251%	78%	4.3	1	0

Proportion of firms that are delisted or do not qualify as going concerns 3 years after the IPO

	N	Number of firms delisted or in distress	Percentage of firms delisted or in distress
Data for Small Cap market tier stocks			
1983-1991	308	71	23%
1991-1997	290	86	30%
1997-2003	73	22	30%
1983-2003	671	179	27%
Data for Nasdaq/Nasdaq National Market System market tier stocks			
1980-1983	375	5	1%
1983-1985	445	22	5%
1985-1987	484	23	5%
1987-1989	129	6	5%
1989-1997	2,203	106	5%
1997-2001	997	112	11%
2001-2003	95	5	5%
1983-2003	4,353	274	6%

Table 2.3 (continued)

Selected statistics for first day abnormal returns (underpricing)

Data for Small Cap market tier stocks

	N	Mean	Median	Variance	Skewness	Kurtosis
1983-1991	308	17%	6%	0.07	2	4
1991-1997	290	18%	8%	0.11	2	6
1997-2003	73	10%	7%	0.04	1	0
1983-2003	671	17%	7%	0.08	2	6
Data for Nasdaq/Nasdaq National Market System market tier stocks						
1980-1983	375	17%	5%	0.25	12	192
1983-1985	445	10%	3%	0.03	3	9
1985-1987	484	8%	3%	0.02	3	18
1987-1989	129	6%	2%	0.01	2	6
1989-1997	2,203	14%	8%	0.04	2	10
1997-2001	997	57%	24%	0.74	3	9
2001-2003	95	12%	8%	0.03	1	1
1983-2003	4,353	23%	8%	0.23	5	36

Selected statistics for spread one month after Initial Public Offering

Data for Small Cap market tier stocks

	N	Mean	Median	Variance	Skewness	Kurtosis
1983-1991	29	5%	4%	0.002	3	9
1991-1997	289	6%	5%	0.002	3	14
1997-2003	72	4%	3%	0.001	1	2
1983-2003	390	6%	5%	0.002	3	14
Data for Nasdaq/Nasdaq National Market System market tier stocks						
1980-1983	162	3%	2%	0.001	2	3
1983-1985	217	4%	3%	0.002	5	31
1985-1987	206	3%	3%	0.000	1	0
1987-1989	93	3%	3%	0.001	1	2
1989-1997	2,140	4%	3%	0.001	5	55
1997-2001	992	1%	1%	0.000	3	21
2001-2003	95	1%	1%	0.000	3	12
1983-2003	3,743	3%	2%	0.001	4	49

Selected statistics for liquidity (number of shares traded/number of shares publicly outstanding) in the first year after Initial Public Offering

Data for Small Cap market tier stocks

	N	Mean	Median	Variance	Skewness	Kurtosis
1983-1991	308	0.4	0.3	0.08	3	18
1991-1997	290	0.7	0.6	0.34	3	13
1997-2003	73	1.2	0.6	9.77	7	48
1983-2003	671	0.6	0.4	1.30	16	314
Data for Nasdaq/Nasdaq National Market System market tier stocks						
1980-1983	139	0.4	0.3	0.08	2	4
1983-1985	445	0.3	0.2	0.08	12	213
1985-1987	484	0.4	0.3	0.08	2	6
1987-1989	129	0.5	0.4	0.18	3	16
1989-1997	2,203	0.7	0.6	0.21	2	10
1997-2001	997	1.2	0.9	1.12	3	14
2001-2003	95	0.8	0.7	0.36	3	10
1983-2003	4,353	0.7	0.5	0.47	4	29

Table 2.3 (continued)

Selected statistics for variance ratio (deviation from one) in the first year after Initial Public Offering

Data for Small Cap market tier stocks

	N	Mean	Median	Variance	Skewness	Kurtosis
1983-1991	308	0.3	0.2	0.05	2	7
1991-1997	290	0.4	0.4	0.04	0	-1
1997-2003	73	0.3	0.3	0.03	0	-1
1983-2003	671	0.3	0.3	0.05	1	2
Data for Nasdaq/Nasdaq National Market System market tier stocks						
1980-1983	375	0.3	0.3	0.04	1	1
1983-1985	445	0.3	0.3	0.05	1	1
1985-1987	484	0.3	0.2	0.04	1	0
1987-1989	129	0.3	0.2	0.04	1	-1
1989-1997	2,203	0.2	0.2	0.03	1	0
1997-2001	997	0.2	0.1	0.01	1	3
2001-2003	95	0.2	0.1	0.02	1	2
1983-2003	4,353	0.2	0.2	0.03	1	1

Selected statistics standard deviation of residual returns in the first year after Initial Public Offering

Data for Small Cap market tier stocks

	N	Mean	Median	Variance	Skewness	Kurtosis
1983-1991	308	0.037	0.03	0.0003	1	1
1991-1997	290	0.062	0.06	0.0007	2	5
1997-2003	73	0.076	0.07	0.0010	1	2
1983-2003	671	0.052	0.05	0.0007	2	4
Data for Nasdaq/Nasdaq National Market System market tier stocks						
1980-1983	375	0.033	0.03	0.0001	2	8
1983-1985	445	0.029	0.03	0.0001	2	8
1985-1987	484	0.037	0.03	0.0002	1	3
1987-1989	129	0.039	0.03	0.0004	2	4
1989-1997	2,203	0.043	0.04	0.0002	1	5
1997-2001	997	0.069	0.07	0.0005	3	35
2001-2003	95	0.040	0.04	0.0003	2	7
1983-2003	4,353	0.047	0.04	0.0004	2	17

Selected statistics for R-squared of regression of daily stock returns on Nasdaq's equally weighted index returns variable in the first year after Initial Public Offering

Data for Small Cap market tier stocks

	N	Mean	Median	Variance	Skewness	Kurtosis
1983-1991	308	0.04	0.02	0.003	3	10
1991-1997	290	0.01	0.01	0.000	3	8
1997-2003	73	0.04	0.02	0.001	2	5
1983-2003	671	0.03	0.01	0.002	3	15
Data for Nasdaq/Nasdaq National Market System market tier stocks						
1980-1983	375	0.11	0.10	0.005	1	0
1983-1985	445	0.06	0.04	0.003	1	1
1985-1987	484	0.09	0.05	0.010	2	2
1987-1989	129	0.11	0.06	0.012	1	0
1989-1997	2,203	0.05	0.04	0.002	1	1
1997-2001	997	0.12	0.10	0.007	1	0
2001-2003	95	0.07	0.05	0.003	1	1
1983-2003	4,353	0.07	0.05	0.005	2	3

Table 2.4.: Impact of Changes in Listing Standards on IPO Firms' Quality (1980-2003)
The table shows regressions in which dependent variables that measure firms' performance are three-year raw stock returns, return on assets, asset turnover and proportion of firms that qualify as going concerns three years after the IPO. Logistic models employ dependent variables that are equal to one if a firm remains listed on Nasdaq and qualifies as a going concern three years after the Initial Public Offering, has positive three-year post-IPO returns and return on assets, and if its asset turnover exceeds 100 percent. Liquidity and market efficiency measures include first day returns (underpricing), spreads one month after the IPO date, liquidity, deviation of the variance ratio from value of one, standard deviation of residual returns and R-squared of regressions of daily stock returns on the Nasdaq equally weighted index return in the first year after the IPO. Liquidity is defined as the number of shares traded divided by the number of publicly outstanding shares. Spread is calculated one month after the Initial Public Offering. Data for liquidity - number of shares traded divided by number of shares publicly held, deviation of variance ratio from one, standard deviation of residual returns and R-squared of regression of daily stock returns on Nasdaq equally weighted index are based on data in the first year after the Initial Public Offering. Variance ratio equals five-day stock return variances over one-day variances multiplied by five. Regression models employ a measure of absolute deviation of the variance ratio from the value of one. Results are reported separately for each market tier and for different time periods corresponding to various listing regimes. Operating performance measures - return on assets and asset turnover - are winsorized at a five percent level to mitigate the influence of outliers. Explanatory variables include dummies that represent various listing standards on Nasdaq, characteristics of the offering, use of the proceeds and market conditions. Data are based on 1980-2003. T-statistics and Wald Chi-Square statistics are reported in brackets. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Multivariate models			Logistic models			
Dependent variable	Three year stock return	Asset profitability	Asset turnover	Three year stock return	Asset profitability	Asset turnover	Going concern
Constant	-0.10	-0.41***	2.98***	-1.00***	-0.21	1.73***	1.76***
SMCAP1983_1991	-0.50***	-0.56***	-0.37**	-1.02***	-1.54***	-0.51**	-2.33***
SMCAP1991_1997	-0.48***	-1.12***	-1.39***	-1.14***	-2.85***	-1.86***	-4.55***
SMCAP1997_2003	-0.73***	-0.86***	-0.90**	-2.05***	-2.14***	-1.50***	-3.85***
NMS1983_1985	-0.12	-0.01	0.54***	-0.17	-0.17	0.84***	-0.96***
NMS1985_1987	-0.12	-0.10*	0.35**	-0.33**	-0.33**	0.18	-1.42***
NMS1987_1989	-0.06	-0.08	0.29	-0.37	-0.37	-0.25	-1.20*
NMS1989_1997	-0.33**	-0.48***	-1.00***	-0.65***	-0.65***	-1.33***	-3.87***
NMS1997_2001	-0.60***	-0.83***	-1.13***	-1.59***	-1.59***	-1.36***	-3.74***
NMS2001_2003	-0.12	-0.40***	-0.44*	0.16	0.16	-0.63*	-3.47***
LogAssets	0.01	0.10***	0.02	0.16***	0.16***	-0.10**	0.20***
Underwriter ranking	0.06***	0.03***	-0.00	0.06***	0.06***	0.04	0.24***
Venture capital	0.06	-0.22***	-0.66***	-0.03	-0.74***	-0.54***	0.39**
Working Capital	-0.27**	-0.26***	-0.31***	-0.30**	-0.67***	-0.23*	0.35*
Debt	-0.07	0.15***	0.91***	0.03	0.51***	0.84***	-0.38***
Hotmarket	-0.20***	-0.05***	-0.13**	-0.27***	-0.15***	0.06	-0.13
Market return	0.25***	0.11***	0.42**	0.23***	0.38***	0.50***	1.82***
N. of observations	5093	4785	4785	5093	4785	4785	5093
Adjusted R-Sq	3.53%	25.72%	17.81%				
Loglikelihood Ratio Chi-Sq				476.88***	1152.05***	545.45***	756.11***

Table 2.4 (continued)

Dependent variable	First day return	Spread	Liquidity	Variance ratio (difference from value of one)	St.deviation of residual stock returns	R-squared
Constant	0.05	0.055***	0.001	0.40***	0.040***	0.062***
SMCAP1983_1991	0.07*	0.015***	0.002**	-0.06***	0.004**	-0.047***
SMCAP1991_1997	0.05	0.022***	0.003***	0.08***	0.031***	-0.061***
SMCAP1997_2003	-0.10*	0.003	0.008***	0.02	0.045***	-0.063***
NMS1983_1985	-0.07**	0.010***	0.001*	0.04***	-0.002	-0.066***
NMS1985_1987	-0.04	0.006**	0.002***	0.00	0.011***	-0.028***
NMS1987_1989	-0.04	0.006*	0.003***	-0.01	0.013***	-0.013**
NMS1989_1997	-0.03	0.012***	0.003***	-0.01	0.018***	-0.061***
NMS1997_2001	0.28***	-0.005***	0.008***	-0.06***	0.042***	-0.023***
NMS2001_2003	-0.13***	-0.008***	0.005***	-0.06***	0.015***	-0.075***
LogAssets	0.01	-0.005***	-0.000	-0.02***	-0.003***	0.009***
Underwriter ranking	0.00	-0.001***	0.000	-0.01***	-0.001***	0.005***
Venture capital	0.05***	-0.000	0.001**	-0.01**	0.005***	0.010***
Working Capital	0.13***	-0.000	0.001	-0.01	0.006***	0.009***
Debt	-0.08***	0.003***	-0.001***	0.03***	-0.002***	-0.012***
Hotmarket	0.13***	-0.003***	0.001***	-0.03***	0.002***	0.004**
Market return	6.93***	-0.031***	0.006***	-0.03	-0.004***	-0.034***
N. of observations	5093	4163	4905	5093	5093	5093
Adjusted R-Sq	18.20%	31.45%	16.92%	14.05%	43.47%	27.49%

Table 2.5.: Impact of Changes in Listing Standards on IPO Firms' Quality (1983-2003)
The table shows regressions, in which dependent variables that measure firms' performance are three-year raw stock returns, return on assets, asset turnover and the proportion of firms that qualify as going concerns three years after the IPO. Logistic models employ dependent variables that are equal to one if a firm remains listed on Nasdaq and qualifies as a going concern three years after the Initial Public Offering, has positive three-year post-IPO returns and return on assets, and if its asset turnover exceeds 100 percent. Liquidity and market efficiency measures include first day returns (underpricing), spreads one month after the IPO date, liquidity, deviation of variance ratio from value of one, standard deviation of residual returns and R-squared of regressions of daily stock returns on the Nasdaq equally weighted index return in the first year after the IPO. Liquidity is defined as the number of shares traded divided by the number of publicly outstanding shares. Spread is calculated one month after the Initial Public Offering. Data for liquidity - number of shares traded divided by number of shares publicly held, deviation of variance ratio from one, standard deviation of residual returns and R-squared of regression of daily stock returns on Nasdaq equally weighted index are based on data in the first year after the Initial Public Offering. Variance ratio equals five-day stock return variances over one-day variances multiplied by five. Regression models employ a measure of absolute deviation of the variance ratio from the value of one. Results are reported separately for each market tier and for different time periods corresponding to various listing regimes. Operating performance measures - return on assets and asset turnover - are winsorized at a five percent level to mitigate the influence of outliers. Explanatory variables include dummies that represent various listing standards on Nasdaq, characteristics of the offering, use of the proceeds and market conditions. The Nasdaq/NMS dummy is equal to one if the firm was listed on the upper market tier. Data are based on 1983-2003. T-statistics and Wald Chi-Square statistics are reported in brackets. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Multivariate models			Logistic models			
Dependent variable	Three year stock return	Asset profitability	Asset turnover	Three year stock return	Asset profitability	Asset turnover	Going concern
Constant	-0.61***	-1.20***	2.24***	-2.10***	-2.20***	0.73***	-1.01***
NMS1985_1987	-0.09	-0.08	-0.17	-0.15	-0.15	-0.65**	-0.40
NMS1987_1989	0.06	-0.05	-0.21	-0.19	-0.06	-1.04***	-0.24
NMS1989_1997	-0.19	-0.38***	-1.36***	-0.45***	-1.28***	-1.93***	-2.18***
NMS1997_2001	-0.48***	-0.76***	-1.54***	-1.38***	-2.23***	-2.01***	-2.23***
NMS2001_2003	0.02	-0.32***	-0.81***	0.37	-1.08***	-1.23***	-1.94***
Nasdaq/NMS	0.41***	0.82***	1.44***	1.02***	2.43***	2.09***	2.14***
LogAssets	0.01	0.08***	-0.04	0.16***	0.09**	-0.20***	0.05
Underwriter ranking	0.06***	0.03***	0.00	0.05***	0.11***	0.06**	0.29***
Venture capital	0.07	-0.24***	-0.69***	-0.04	-0.80***	-0.59***	0.37***
Working Capital	-0.28**	-0.26***	-0.32***	-0.33**	-0.67***	-0.26**	0.21
Debt	-0.06	0.14***	0.89***	0.03	0.48***	0.82***	-0.40***
Hotmarket	-0.19***	-0.07***	-0.16**	-0.28***	-0.16**	0.02	-0.41***
Market return	0.24***	0.10***	0.35***	0.22***	0.31***	0.39***	1.35***
N. of observations	4797	4492	4492	4797	4492	4492	4797
Adjusted R-Sq	3.53%	24.57%	18.32%				
Loglikelihood Ratio Chi-Sq				448.39***	1084.14***	516.41***	655.54***

Table 2.5 (continued)

Dependent variable	First day return	Spread	Liquidity	Variance ratio (difference from value of one)	St.deviation of residual stock returns	R-squared
Constant	0.08***	0.07***	0.004***	0.41***	0.058***	0.010***
NMS1985_1987	0.02	-0.00	0.001	-0.04***	0.012***	0.039***
NMS1987_1989	0.03	-0.00	0.002**	-0.05***	0.014***	0.054***
NMS1989_1997	0.04*	0.00	0.001*	-0.06***	0.016***	0.009**
NMS1997_2001	0.36***	-0.01***	0.006***	-0.11***	0.040***	0.047***
NMS2001_2003	-0.06	-0.02***	0.003***	-0.10***	0.012***	-0.006
Nasdaq/NMS	-0.12***	-0.008***	-0.002	0.05***	-0.021***	-0.012**
LogAssets	0.01	-0.005***	0.000	-0.01***	-0.002***	0.008***
Underwriter ranking	0.01*	-0.002***	0.000	-0.01***	-0.001***	0.005***
Venture capital	0.05***	-0.00	0.0004**	-0.02***	0.005***	0.008***
Working Capital	0.13***	-0.00	0.001**	-0.01	0.008***	0.009**
Debt	-0.08***	0.004***	-0.001***	0.02***	-0.002***	-0.013***
Hotmarket	0.12***	0.004***	0.001***	-0.02***	0.004***	0.003
Market return	7.08***	-0.03***	0.006***	0.01	0.001	-0.037***
N. of observations	4797	4030	4797	4797	4797	4797
Adjusted R-Sq	19.38%	31.42%	15.95%	13.95%	36.55%	26.36%

Table 2.6.: Multivariate and Logistic Regressions that Describe the Impact of Change of Listing Standards in 1985 on Nasdaq National Market System IPO Firms

Panel I includes multivariate regression models with various performance measures as dependent variables. Panel II includes logistic models with various performance measures as dependent variables. Panel III includes multivariate regressions with various liquidity/market efficiency measures as dependent variables. The working capital variable is omitted due to lack of data. Data are based on 1983-1987.

	Intercept	NMS1985_1987	LogAssets	Underwriter ranking	Venture capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
I. Three year raw stock return	-0.33*	-0.18	0.12***	0.01	0.03	0.04	-0.20**	0.67***	825	2.30%
Asset profitability	-0.59***	-0.09**	0.05***	0.07***	-0.14***	0.05	-0.05	0.31***	763	14.55%
Asset turnover	2.87***	-0.27	-0.06	0.11**	-0.82***	0.65***	-0.13	1.31***	763	7.25%
	Intercept	NMS1985_1987	LogAssets	Underwriter ranking	Venture capital	Debt	Hotmarket	Market return	N	Loglikelihood Ratio Chi-Sq
II. Three year raw stock return	-1.39***	-0.20	0.37***	-0.02	0.00	0.06	-0.42***	0.75	825	43.50***
Asset profitability	-1.16***	-0.34	0.23**	0.25***	-0.91***	0.29	-0.14	1.00*	763	87.74***
Asset turnover	1.24***	-1.08***	0.04	0.16**	-0.54**	0.71**	-0.40	2.23**	763	25.65***
Going concern	0.06	-1.26**	0.02	0.35***	0.29	-0.65	-0.12	7.35***	825	54.19***
	Intercept	NMS1985_1987	LogAssets	Underwriter ranking	Venture capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
III. First Day Raw Return	0.16***	0.02	-0.01	-0.01***	0.01	-0.04***	0.10***	4.61***	825	16.55%
Spread	0.069***	-0.001	-0.005***	-0.003***	-0.000	0.006*	0.006**	-0.092***	392	10.85%
Liquidity	0.002***	0.001***	0.0002**	-0.0001	0.0006***	-0.0002	0.0002	0.0021***	825	13.04%
Deviation of variance ratio	0.369***	-0.023	-0.033***	0.006	-0.005	0.001	-0.011	-0.067	825	2.80%
St.deviation of residual stock ret.	0.032***	0.014***	-0.002***	-0.000	0.003***	-0.000	0.002***	-0.023***	825	20.62%
R-squared	-0.025***	0.075***	0.011***	0.004**	0.017***	-0.015**	-0.004	-0.209***	825	20.87%

Table 2.7.: Multivariate and Logistic Regressions that Describe the Impact of Change of Listing Standards in 1987 on Nasdaq National Market System IPO Firms
Panel I includes multivariate regression models with various performance measures as dependent variables. Panel II includes logistic models with various performance measures as dependent variables. Panel III includes multivariate regressions with various liquidity/market efficiency measures as dependent variables. The working capital variable is omitted due to lack of data. Data are based on 1985-1989.

	Intercept	NMS1987_1989	LogAssets	Underwriter ranking	Venture capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
I. Three year raw stock return	-0.89***	0.06	0.12**	0.04	0.08	-0.08	-0.10	1.31***	578	5.57%
Asset profitability	-0.50***	0.04	0.03	0.07***	-0.15***	0.05	0.01	0.22*	511	8.73%
Asset turnover	2.81***	-0.02	-0.14	0.10	-0.96***	0.77***	0.20	1.55***	511	9.42%
	Intercept	NMS1987_1989	LogAssets	Underwriter ranking	Venture capital	Debt	Hotmarket	Market return	N	Loglikelihood Ratio Chi-Sq
II. Three year raw stock return	-2.31***	-0.15	-0.40***	0.04	0.11	0.03	-0.09	0.92**	578	39.19***
Asset profitability	-1.06***	0.16	-0.08	0.31***	-0.91***	0.44**	0.15	0.97*	511	38.03***
Asset turnover	1.24*	-0.41	-0.26*	0.13	-0.39	0.78***	-0.11	2.22***	511	21.86***
Going concern	-1.26	1.15*	-0.04	0.38***	0.25	-0.47	0.18	6.78***	578	38.50***
	Intercept	NMS1987_1989	LogAssets	Underwriter ranking	Venture capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
III. First Day Raw Return	0.21***	-0.01	0.00	-0.02***	0.02	-0.03***	0.04***	4.12***	578	9.21%
Spread	0.060***	-0.003	-0.006***	-0.001	-0.000	0.005**	-0.002	-0.082***	293	22.97%
Liquidity	0.0040***	0.0008***	0.0003**	-0.0002**	0.0012***	-0.0003	0.0001	0.0025**	578	5.29%
Deviation of variance ratio	0.34***	-0.05	-0.03***	0.01	-0.05***	0.00	0.02	-0.17**	578	3.56%
St.deviation of residual stock ret.	0.055***	0.001	-0.003***	-0.000	0.001	0.001	0.002	-0.054***	578	23.94%
R-squared	0.071***	-0.000	0.014***	0.005**	0.009	-0.015**	-0.004	-0.49***	578	3.00%

Table 2.8.: Multivariate and Logistic Regressions that Describe the Impact of Change of Listing Standards in 1989 on Nasdaq National Market System IPO Firms

Panel I includes multivariate regression models with various performance measures as dependent variables. Panel II includes logistic models with various performance measures as dependent variables. Panel III includes multivariate regressions with various liquidity/market efficiency measures as dependent variables. Data are based on 1987-1997.

	Intercept	NMS1989_1997	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
I. Three year raw stock return	-0.33	-0.08	0.09***	0.09***	0.16	0.42	-0.06	-0.12	0.12**	2288	0.99%
Asset profitability	-0.47***	-0.34***	0.03***	0.03***	-0.20***	-0.13	0.18***	-0.01	0.06***	2151	10.54%
Asset turnover	3.54***	-1.21***	-0.01	-0.01	-0.66***	-0.33	1.05***	-0.11	0.37***	2151	14.86%
	Intercept	NMS1989_1997	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Loglikelihood Ratio Chi-Sq
II. Three year raw stock return	-1.32***	-0.09	0.07**	0.07**	-0.02	0.14	0.06	-0.19***	0.10***	2288	43.35***
Asset profitability	0.17	-1.19***	0.09***	0.09***	-0.69***	-0.32	0.61***	-0.06	0.26***	2151	178.46***
Asset turnover	1.80***	-0.94***	0.06*	0.06*	-0.64***	0.41	0.88***	0.18	0.37***	2151	142.41***
Going concern	-0.40	-2.41***	0.24***	0.24***	0.17	0.14	-0.36*	-0.01	1.51***	2288	177.73***
	Intercept	NMS1989_1997	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
III. First Day Raw Return	0.07***	0.04***	0.00	0.00	0.01	0.03	-0.04***	0.09***	2.34***	2288	7.90%
Spread	0.063***	0.007***	-0.002***	-0.002***	0.000	-0.004	0.003***	-0.005***	-0.034***	2193	13.73%
Liquidity	0.004***	0.001*	0.000	0.000	0.001***	-0.000	-0.001***	0.0005***	0.0023***	2288	4.94%
Deviation of variance ratio	0.46***	-0.01	-0.02***	-0.02***	-0.02***	-0.04	0.04***	-0.02***	0.02	2288	12.79%
St.deviation of residual stock ret.	0.057***	0.006***	-0.004***	-0.001***	0.003***	-0.000	-0.002***	0.001	-0.003***	2288	13.93%
R-squared	0.064***	-0.047***	0.004***	0.005***	0.007***	0.002	-0.007***	0.002	-0.029***	2288	15.08%

Table 2.9.: Multivariate and Logistic Regressions that Describe the Impact of Change of Listing Standards in 1997 on Nasdaq National Market System IPO Firms

Panel I includes multivariate regression models with various performance measures as dependent variables. Panel II includes logistic models with various performance measures as dependent variables. Panel III includes multivariate regressions with various liquidity/market efficiency measures as dependent variables. Data are based on 1989-2001.

	Intercept	NMS1997_2001	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
I. Three year raw stock return	-0.36	-0.34***	-0.03	0.08***	-0.09	-0.31**	-0.03**	-0.16*	0.19***	3147	2.95%
Asset profitability	-0.76***	-0.34***	0.07***	0.03***	-0.27***	-0.25***	0.21***	-0.03	0.09***	2986	21.04%
Asset turnover	2.46***	-0.06	-0.08*	-0.02	-0.70***	-0.30***	1.00***	-0.13*	0.39***	2986	22.06%
	Intercept	NMS1997_2001	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Loglikelihood Ratio Chi-Sq
II. Three-year raw stock return	-1.35***	-0.97***	0.10*	0.07***	-0.09	-0.31*	0.09	-0.23***	0.17***	3147	268.20***
Asset profitability	-0.76***	-0.82***	0.03	0.08***	-0.83***	-0.71***	0.62***	-0.10	0.34***	2986	635.27***
Asset turnover	1.08***	-0.00	-0.31***	0.07**	-0.74***	-0.16	0.95***	0.14	0.44***	2986	406.24***
Going concern	-1.70***	-0.12	0.07	0.29***	0.26	0.45**	-0.17	0.05	1.48***	3147	277.05***
	Intercept	NMS1997_2001	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
III. First Day Raw Return	-0.12***	0.28***	0.03***	0.01*	0.08***	0.14***	-0.10***	0.12***	8.49***	3147	18.63%
Spread	0.066***	-0.017***	-0.004***	-0.002***	0.000	-0.002	0.002***	-0.005***	-0.02***	3082	35.13%
Liquidity	0.003***	0.006***	-0.000	0.0002**	0.0006**	-0.0002	-0.0009***	0.0007***	0.0066***	3147	15.01%
Deviation of variance ratio	0.44***	-0.04***	-0.017***	-0.018***	-0.015**	-0.004	0.032***	-0.026***	-0.003	3147	15.61%
St.deviation of residual stock ret.	0.057***	0.025***	-0.003***	-0.001***	0.006***	0.005***	-0.004***	0.002***	-0.001	3147	40.50%
R-squared	-0.007	0.040***	0.009***	0.005***	0.007***	0.010***	-0.014***	0.007***	-0.020***	3147	29.84%

Table 2.10.: Multivariate and Logistic Regressions that Describe the Impact of Change of Listing Standards in 2001 on Nasdaq National Market System IPO Firms

Panel I includes multivariate regression models with various performance measures as dependent variables. Panel II includes logistic models with various performance measures as dependent variables. Panel III includes multivariate regressions with various liquidity/market efficiency measures as dependent variables. Data are based on 1997-2003.

	Intercept	NMS2001_2003	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
I. Three year raw stock return	-0.42	0.29	-0.04	0.005	0.03	-0.28**	-0.10	-0.26	0.90***	1080	5.38%
Asset profitability	-0.89***	0.34***	0.04	0.01	-0.35***	-0.22***	0.24***	-0.09	0.30***	1042	16.39%
Asset turnover	2.78***	0.72***	-0.11*	-0.08*	-0.74***	-0.28***	0.81***	0.00	0.71***	1042	22.33%
	Intercept	NMS2001_2003	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Loglikelihood Ratio Chi-Sq
II. Three year raw stock return	-2.36***	1.60***	-0.07	0.07	-0.18	-0.21	0.11	-0.39*	1.23***	1080	147.68***
Asset profitability	-0.47	1.17***	-0.15	-0.04	-1.04***	-0.63***	0.49***	-0.04	1.22***	1042	215.47***
Asset turnover	1.29***	0.75**	-0.42***	0.06	-0.71***	-0.20	1.04***	0.14	0.94***	1042	178.76***
Going concern	-1.87***	0.53	-0.08	0.38***	0.36	0.30	0.15	0.12	1.33***	1080	76.43***
	Intercept	NMS2001_2003	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
III. First Day Raw Return	-0.73***	-0.34***	0.08***	0.06***	0.18***	0.14***	-0.18***	0.31***	10.99***	1080	13.35%
Spread	0.039***	-0.002*	-0.002***	-0.002***	0.000	-0.001	0.002**	-0.002**	-0.024***	1075	18.05%
Liquidity	0.00	-0.002	-0.000	0.001***	-0.001	0.000	-0.001	0.002**	0.011***	1080	13.79%
Deviation of variance ratio	0.290***	-0.002	-0.011**	-0.006**	-0.007	0.000	0.008	-0.027**	-0.038***	1080	3.11%
St.deviation of residual stock ret.	0.06***	-0.02***	-0.002**	-0.000	0.010***	0.005***	-0.006***	0.010***	-0.001	1080	22.63%
R-squared	-0.05*	-0.04***	0.02***	0.01***	0.00	0.01**	-0.03***	0.03***	-0.02**	1080	17.93%

Table 2.11.: Multivariate and Logistic Regressions that Describe the Impact of Change of Listing Standards in 1991 on Nasdaq SmallCap Market IPO Firms

Panel I includes multivariate regression models with various performance measures as dependent variables. Panel II includes logistic models with various performance measures as dependent variables. Panel III includes multivariate regressions with various liquidity/market efficiency measures as dependent variables. Data are based on 1983-1997.

	Intercept	SMCAP1991_1997	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
I. Three year raw stock return	-0.39**	-0.23	0.01	0.00	0.02	-0.42	-0.12	-0.26*	0.41***	533	3.50%
Asset profitability	-1.19***	-0.70***	0.32***	0.01	-0.21*	-0.36	-0.17**	-0.11	0.19***	470	14.02%
Asset turnover	2.49***	-0.94***	0.36***	-0.09*	-0.28	-0.79	0.53***	-0.14	0.26*	470	4.08%
	Intercept	SMCAP1991_1997	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Loglikelihood Ratio Chi-Sq
II. Three year raw stock return	-2.02***	-0.61***	0.09	0.05	0.34	-14.01	-0.41*	-0.08	0.65***	533	25.51***
Asset profitability	-1.80***	-1.53***	0.42***	0.05	-0.32	-12.59	-0.49*	-0.25	0.60***	470	37.17***
Asset turnover	1.46***	-1.75***	0.26*	-0.18***	-0.16	-2.24**	0.56**	0.19	0.56***	470	36.89***
Going concern	-0.42	-3.33***	0.31***	0.12*	0.63*	-0.82	-0.73***	-0.22	2.79***	533	177.80***
	Intercept	SMCAP1991_1997	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
III. First Day Raw Return	0.21***	-0.04	-0.04**	-0.00	-0.08***	0.12	-0.00	0.19***	0.03	533	11.02%
Spread	0.07***	0.01	-0.01***	0.00	-0.00	0.04**	0.01*	-0.01*	-0.05	300	6.03%
Liquidity	0.003***	0.001**	0.000	-0.000	-0.000	-0.000	0.000	0.001***	0.003***	533	15.57%
Deviation of variance ratio	0.26***	0.16***	-0.005	0.005	0.006	-0.061	0.003	-0.025	-0.019	533	8.76%
St.deviation of residual stock ret.	0.042***	0.027***	-0.002*	-0.000	0.000	0.038***	0.000	0.001	-0.007	533	25.66%
R-squared	0.035***	-0.011*	0.002	0.002*	0.002*	-0.015	0.003	0.003	-0.045***	533	13.64%

Table 2.12.: Multivariate and Logistic Regressions that Describe the Impact of Change of Listing Standards in 1997 on Nasdaq SmallCap Market IPO Firms

Panel I includes multivariate regression models with various performance measures as dependent variables. Panel II includes logistic models with various performance measures as dependent variables. Panel III includes multivariate regressions with various liquidity/market efficiency measures as dependent variables. Data are based on 1991-2003.

	Intercept	SMCAP1997_2003	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
I. Three year raw stock return	-0.85***	-0.09	0.09	-0.02	-0.25	0.23	-0.20	-0.36*	0.56***	350	6.09%
Asset profitability	-2.31***	0.15	0.42***	-0.37***	-0.37***	-0.12	-0.02	0.00	0.29***	320	13.28%
Asset turnover	1.07**	0.09	0.39**	-0.30	-0.30	0.05	0.77***	0.04	0.34**	320	4.35
	Intercept	SMCAP1997_2003	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Loglikelihood Ratio Chi-Sq
II. Three year raw stock return	-3.15***	-0.31	0.17	-0.01	-0.01	-0.16	-0.48	-0.18	1.04***	350	32.70***
Asset profitability	-5.17***	1.13***	0.49**	-0.52	-0.52	0.14	0.44	0.10	1.23***	320	32.84**
Asset turnover	-0.33	0.57	0.05	-0.32	-0.32	-1.06**	0.62**	0.26	0.58***	320	23.18***
Going concern	-4.92***	1.08**	0.72***	0.51	0.51	0.13	-0.39	-0.24	2.90***	350	166.23***
	Intercept	SMCAP1997_2003	LogAssets	Underwriter ranking	Venture capital	Working Capital	Debt	Hotmarket	Market return	N	Adj. R-sq.
III. First Day Raw Return	0.08	-0.13*	-0.02	-0.08*	-0.08*	0.07	-0.01	0.16***	0.10	350	7.29%
Spread	0.08***	-0.02***	-0.01***	-0.00	-0.00	0.01	0.01**	-0.01	-0.04	348	9.19%
Liquidity	0.007**	0.004*	-0.000	-0.002	-0.002	0.008**	-0.000	-0.000	0.005	350	1.54%
Deviation of variance ratio	0.51***	-0.05*	-0.04**	-0.04	-0.04	-0.07	0.01	-0.00	-0.04	350	4.49%
St.deviation of residual stock ret.	0.085***	0.011**	-0.006***	0.002	0.002	0.015**	0.000	0.001	-0.022***	350	10.18%
R-squared	0.002	0.008**	0.005***	0.003	0.003	0.016***	-0.004	0.002	-0.011*	350	17.97%

3. Timing Issues and Effects of Regulation in the Reverse Mergers Market

3.1. Introduction

Initial Public Offerings have been widely covered in the financial literature, which has documented several findings, including short-run overpricing, long-run underperformance, IPO clustering and comparatively worse performance of firms that go public in high-volume years. However, a lot of companies, especially in the universe of small and medium-size firms, choose to go public through the acquisition of shell companies, a technique that is known as Reverse Mergers or Reverse Takeovers, which refer to a corporate governance event in which shareholders of an acquiring company yield control over a merged entity to shareholders of the target firm. Most often, a publicly traded company takes over a private business, but there are cases when merger-of-equals and transactions between two private companies are structured as reverse takeovers (RTOs).

The current study attempts to explain the timing of reverse takeovers using a sample for 1995-2006 period using proxies for capital demands, information asymmetry, investor sentiment and current macroeconomic conditions. We also examine the effects of changes in the regulatory environment on the market for reverse mergers.

3.1.1. Hypotheses

The major hypothesis we put in this paper is the *Cold Market Hypothesis,* which predicts that companies will choose to go public through reverse takeovers

when financing is not available through the regular IPO mechanism. Consequently, we should observe an increase in the number of reverse takeovers when measures of business activity are down and when IPO volume is lower. We expect to find negative correlation between the number of reverse mergers that we classify as alternatives to IPOs and Initial Public Offerings. In addition, we expect to observe negative association between reverse takeovers that are equivalent to IPOs and various proxies for capital demands, information asymmetries, investor sentiment and current macroeconomic conditions.

We observe a large difference in the number of reverse mergers prior to 2000-2001 and afterwards. In part, this difference is due to business cycle effects, but it is also related to changes in the regulatory environment. We examine how these changes affected the reverse mergers market by putting to test the *Increased Regulation Hypothesis*. We expect that increased regulation led to increase in the quality of the reverse merger firms focusing on two measures: information asymmetry in the market for RTO firms' stock and performance characteristics.

3.1.2. Classification of Reverse Mergers

For the purposes of our study, we separate the population of publicly traded companies that engage in reverse mergers with privately held firms into two groups, including firms that qualify as going concerns and those in financial distress. These subpopulations have different characteristics and exhibit different timing and performance patterns.

We show that most of the transactions in which private firms assume control over distressed publicly traded firms take place when IPO windows are closed. Most of the transactions in which publicly traded firms do not qualify as going concerns follow the same timing pattern as regular mergers. We classify the transactions in which public firms are in financial distress as alternatives to Initial Public Offerings because the major reason for a privately-held company to acquire a firm in distress is to go public. This motive is confirmed by the description of these deals in the U.S. Securities and Exchange Commission's Edgar database and by pre-merger or post-merger sales of assets of public firms. We will refer to this type of transaction as a Reverse Merger-IPO.

Alternatively, reverse takeovers, in which publicly traded firms are financially sustainable, are similar to regular mergers. If a privately owned firm is in the same line of business as the publicly traded firm, as evidenced by matching the SIC codes and description of both acquiror and target firms in the S.E.C. filings, and if the publicly traded firm is a going concern, we classify such deals as Reverse Merger-Takeovers. We will use these terms – Reverse Merger-IPO and Reverse Merger-Takeover – throughout this article to differentiate between the two different types of transactions. In section 4, we provide a more detailed comparison of Reverse Mergers-IPOs, Reverse Mergers-Takeovers and regular mergers. Reported results provide support for our classification of reverse mergers into two categories of transactions. We will use the terms reverse merger (RM) and reverse takeover (RTO) interchangeably throughout the remainder of our study.

Our results indicate that Reverse Merger-IPOs are counter-cyclical to regular Initial Public Offerings. RTO-Mergers, on the other hand, are pro-cyclical to aggregate merger waves. In addition, we provide further evidence that increased regulation may have adverse consequences for capital markets. We show that changes in listing requirements pushed reverse mergers to less regulated and more opaque over-the-counter market, which became a dominant venue for reverse takeovers after 2001.

The paper is organized as follows. The literature review and motivation for tested hypotheses are presented in the next section. Section 3.3 provides an overview of the RTO market. Section 3.4 describes the data. Section 3.5 brings the analyses of timing patterns for two different types of reverse mergers. Section 3.6 analyzes the reverse mergers firms' performance and the price run-ups prior to the announcement in the context of regulatory changes that affected the RTO market. Primary conclusions drawn from this research appear in section 3.7.

3.2. Related Literature and Research Questions

3.2.1. The Cold Market Hypothesis and Model Specifications

The clustering and timing of IPOs are established facts in the academic literature. Ritter (1984) and Ibbotson et al (1994), among others, describe the existence of "hot issue" periods in the IPO market, whereas Mitchell and Mulherin (1996) provide evidence on market timing in merger activity. But,

significantly, if timing[20] is present in the market for Initial Public Offerings and mergers, why do researchers find no evidence of timing in the reverse takeovers market?

Until most recently, the reverse mergers field has been practically ignored by the academic community. We conducted a broad review of academic journals and working papers and found that relevant materials are scarce and sometimes contradict each other. Arellano-Ostoa and Sandro (2002) construct a three-period model and show that there exists a separating equilibrium in which a high-type firm will prefer an Initial Public Offering and a low-type firm will prefer a Reverse Merger.

Gleason et al (2005) make an attempt to look at the timing of reverse mergers and conclude that reverse mergers are used when the IPO market is either hot or cold. They make an observation that 40 percent of the firms in their sample engage in reverse mergers during the hot IPO wave of the mid to late 1990s in a sample of 121 observations in which 64 percent are financially healthy firms.

We believe that the failure to find a timing pattern in the reverse mergers market is due to the fact that these are viewed as one homogeneous population, whereas these include two types of transactions with different characteristics and time dynamics: mergers with non-going concerns used by private firms to go public - IPO alternatives - and deals that are equivalent to regular mergers. The second reason for the failure to locate a timing pattern could be the small sample

[20] Harford (2005) tests whether merger waves could be due to market timing or clustering, which he links, respectively, to behavioral and neoclassical explanations of merger activity. His findings lend support to the neoclassical hypothesis. We do not attempt to differentiate between these two explanations of merger waves and use the word "timing" when referring to RTO-Takeovers without invoking any behavioral connotations.

size used in previous studies – Gleason et al (2005) examine firms listed on exchanges, leaving out the over-the-counter market, which is a major venue for reverse merger transactions.

Our test of timing in the reverse mergers market is based on our separation of the RTO population into two subsamples. We expect RTO-Takeovers to exhibit the same timing pattern as regular mergers. Our prediction for RTO-IPOs is the opposite and is based on the cold market hypothesis outlined in the introduction to this study. Reverse mergers should be used by private firms to obtain access to public financing when IPO windows are shut down. We employ proxies for the private firms' aggregate capital demands, the information asymmetry and the level of investor optimism to examine changes in the number of Reverse Merger-IPOs and Reverse Merger-Takeovers over time.

Capital demands proxies include percentage growth in real gross domestic product (GDP), percentage growth in real private fixed nonresidential investment, real sales growth of public firms and a business cycle dummy. Lowry (2003) suggests that demand for working capital should be positively correlated with future growth in the GDP. Demand for money for new investments should be related to investment opportunities and therefore positively correlated with future growth in investments. We calculate the percentage change in gross domestic product and in real private fixed nonresidential investments over three quarters, beginning with the quarter in which the reverse merger is announced. A business cycle dummy equals one if the Business Cycle Dating Committee of the National

Bureau of Economic Research classifies the next quarter as an expansion and zero if the economy is in a contraction phase.

Future sales should be positively correlated with the demand for equipment and working capital. We employ differences in the log of sales over four quarters – from quarter (t-1) to quarter (t+3) – to take into account seasonality effects.

We obtain data on GDP, sales and investments from The Economic Report of the President. Unlike Lowry (2003), we also examine if changes in GDP, sales and investments prior to the quarter in which the deal is announced are associated with larger or smaller numbers of reverse mergers in both categories of deals. Past information should be incorporated in expectations of managers who make decisions regarding mergers or taking the company public. Also, mergers are costly and often have a cash component, so corporations' past performance, which is related to changes in the broad macroeconomic environment, should have an impact on variations in the number of RTO-IPOs and RTO-Takeovers. Empirical evidence by Harford (1999) supports this argument by showing that firms with large cash reserves are more active in the acquisition market. Increases in the number of RTO-IPOs should be negatively related to improvements in macro conditions in the past and in the future. Changes in volume of RTO-Takeovers should be positively correlated with past and future growth in GDP, investments and sales.

The information asymmetry variables include the dispersion of abnormal returns around public firms' earnings announcements and the dispersion of analyst forecasts of public firms' earnings. Our measures of dispersion in returns

and analyst forecasts are constructed in a similar way as the ones used by Lowry (2003). We identify all firms with earnings announcements in the IBES database and measure the three-day abnormal return around each of these announcements, using the equally weighted Nasdaq index. In the next step, we calculate the standard deviation of abnormal returns in each fiscal quarter. Likewise, we estimate the standard deviation of analysts' quarterly earnings forecasts in each time period. Strong market reaction to earnings announcements and larger deviations of analyst forecasts proxy for high information asymmetry in each period. Myers and Majluf (1984) show that uncertainty about the assets in place prevents firms from issuing equity. In the context of our cold market hypothesis, this implies that information asymmetry variables should be positively correlated with the number of RTO-IPOs and negatively correlated with the number of RTO-Mergers. We construct information asymmetry variables by subtracting the value of each measure in quarter (t-4) from the value in quarter (t-1).

We employ market returns over three quarters, starting with the quarter in which the reverse merger is announced, to proxy for investor sentiment. We also examine the association between the volume of reverse mergers and past market returns. Baker and Wurgler (2000) show that firms tend to issue equity around market peaks and conclude that the firms' managers engage in market timing practices. Loughran et al (1994) show that IPO volume is higher after a period of high market returns. Lowry finds negative association between IPO volume and future market returns, and positive association with market-to-book ratio in the preceding period. We anticipate that more RTO-IPOs take place when market

conditions are bad and investor sentiment is low. RTO-IPO volume should be negatively related to future and past market returns. Our prediction for RTO-Takeovers, however, is the opposite – we expect an increase in their number following a period of positive market returns and high market-to-book ratio in the period prior to merger announcement. This increase is in line with the argument made by Shleifer and Vishny (2003), who suggest that clustering in the merger activity is observed because a substantial portion of merger activity is driven by stock market valuations. However, we do not necessarily expect RTO-Takeovers to be negatively correlated with future returns. If these transactions peak at the same time as IPOs, future returns may be negative, suggesting that firm managers are able to time the market very accurately.

We employ a market-wide market-to-book ratio calculated as the average for all exchange-listed firms in the CRSP/Compustat merged database. Market-to-book is defined as the equally weighted average of individual firm equity market value divided by book value (total shareholders equity – preferred stock + deferred taxes + investment tax credits). Book value is lagged by two quarters in each period to make our results more comparable with those reported for IPOs by Lowry (2003). Firms with book value less than $100,000 and negative value of equity are excluded. We expect RTO-IPOs to be negatively related to the market-to-book ratio and RTO-Takeovers to be positively related to market-to-book.

We examine the association between pre- and post-event[21] market returns in multivariate regressions with RTO volume as dependent variable. In addition, we employ univariate regressions, in which post-event and pre-event stock market

[21] Event is here taken to mean the announcement of a reverse merger.

returns are the dependent variables and the number of RTO-IPOs or RTO-Takeovers is the only explanatory variable to further test whether investor sentiment is one of the drivers of the reverse mergers volume. Lowry (2003) finds a statistically and economically significant negative relationship between post-IPO market returns and the IPO volume, and concludes that these findings suggest that firms successfully time the market, conducting IPOs near market peaks. In a similar vein, Baker and Wurgler (2000) find a negative relationship between the share of equity financing in the volume of capital raised by the firm and future market returns, and conclude that this relationship reflects market timing on behalf of equity-issuing firms.

In the case of Reverse Merger-IPOs, timing should follow a different pattern compared to classic Initial Public Offerings and Seasoned Equity Offerings. Whereas a large number of IPOs are announced after a period of positive market returns and prior to a period of market declines, reverse mergers should take place closer to the trough of the cycle, reflecting negative investor sentiment. If such investor sentiment echoes market losses that occurred in the past and pessimistic expectations about future returns, then we should observe a negative relationship between RTO-IPO volume and both past and future market returns. We expect to observe positive stock market returns prior to the announcement of Reverse Merger-Takeovers.

3.2.2. Increased Regulation Hypothesis

Our study of reverse takeovers covers the period of 1995 through 2006, during which four major regulatory changes that affected Nasdaq and the over-the-counter market took place:

- On January 4, 1999, the S.E.C. approved the 'eligibility rule,' which mandated over-the-counter listed stocks to comply with the reporting obligations under the *Securities Exchange Act of 1934.*
- On March 13, 2001, the S.E.C. required public firms that engage in reverse merger transactions to comply with initial listing standards. Prior to March 2001, new public firms emerging as a result of reverse mergers were required to meet continuing listing rules.
- On August 22, 2005, the S.E.C.'s changes regarding shell companies entered into force. The Commission reduced the reporting period for mergers and acquisitions and the provision of financial statements to four days. It prohibited shells from submitting form S-8 and demanded detailed requirements for filings of 8-K forms.
- In addition, Nasdaq changed its enforcement of listing rules after 2001 as evidenced by the large number of involuntary delistings in 2001-2005 and the difference in reasons for delisting prior to 2001 and afterwards.

The regulatory change that had a major impact on the market was the decision of the Securities and Exchange Commission to approve a Nasdaq-proposed rule to require listed firms to apply for initial inclusion following a reverse merger with a

non-Nasdaq entity March 13, 2001,.[22] Nasdaq's[23] move to require reverse merger firms to comply with initial standards rather than continuing listing rules, coupled with tighter enforcement of the listing rules, had a profound effect on the composition of the reverse mergers market. Reverse mergers-IPO went virtually extinct on exchanges and migrated to the over-the-counter market. The increased regulation hypothesis outlined in the introduction to this study postulates that tighter listing standards lead to increase in quality of the RTO firms. However, if we find that exchange-listed firms are better performers and the market for their stocks is less affected by information asymmetries, then we will conclude that Nasdaq's regulatory interference had broad negative effects as it pushed RTO firms into a less regulated and less transparent market.

Other regulatory changes described earlire appear to have no effect on the reverse mergers market. Bushee and Leuz (2005) studied the economic effects following the introduction of disclosure requirements in 1999 and found that three quarters of the OTC firms not previously filing with the SEC chose not to comply and moved to the Pink Sheets. This change in trading venue does not introduce selection bias into our sample as evidenced by the number of Reverse Takeovers reported by Securities Data Corporation that we are not able to classify as an alternative to merger or an IPO due to lack of data in Edgar. In total, there are 161 reverse mergers reported in SDC that we are unable to classify as RTO-IPO or

[22] Currently, the same requirements are included in the Amex Company Guide and the NYSE Listed Company Manual.

[23] We focus primarily on Nasdaq in this section because 75 percent of all reverse takeovers in our sample announced on exchanges took place on Nasdaq, including 87 percent of all Reverse Merger-IPOs. Also, other exchanges did not experience such large change in listing and de-listing numbers as did Nasdaq around the year 2000.

RTO-Merger, out of which 75 observations pertain to the 1995-1998 period. Growth in reverse mergers on the over-the-counter market after 2005, if any, could be attributed to better disclosure by financially distressed firms because they may reveal themselves as RTO candidates. Instead, we observe a decline in the number of reverse mergers in 2006, suggesting that the change in reporting requirements does not affect our results.

3.3. Overview of the Reverse Mergers Market in 1980-2006

Reverse mergers have a relatively long history, but the market for these transactions assumed a sizeable shape only in last two decades. Figure 3.1 plots the number of reverse mergers in 1990-2006 on an annual basis. The Thomson Financial - Securities Data Corporation (SDC) Merger and Acquisitions Database, which began coverage in 1979, reports the first reverse merger in 1983 and a total of 14 deals in 1980-1989. Twenty-four transactions are recorded in 1990, after which the number of reported deals stays at 60 per year or more. We use the Factiva database to check the number of reverse mergers in 1980-2006. We find that deals are under-reported in Factiva up until 1995 and that, on average, each transaction in SDC has four corresponding hits in Factiva. Despite these differences, the general pattern is similar – Factiva reports very few deals in the 1980s, but substantially increases coverage of these transactions in the 1990s, following the same pattern as we observe in transactions reported in the SDC database. Table 3.1 reports the number of reverse merger transactions by type of

deal – Reverse Merger-IPO or Reverse Merger-Takeover – and by trading floor – OTC or exchange-traded – on an annual basis in the 1995-2006 period.

The growth of the market for reverse takeovers sparked the development of institutional infrastructure to process the increased number of transactions. Given that large investment banking fees are not involved in a transaction with a publicly traded shell or a distressed firm, the 'bulge bracket' and medium-size investment banking firms tend to stay away from this market segment. Reputation effects may also be a reason to avoid the reverse mergers market. Instead, specialized investment service firms or accounting firms occupy the niche. These often maintain a roster of companies available for immediate consummation of a deal, which can be completed in as quickly as 45 days, according to Brenner and Schroff (2004). Often, a distressed firm will engage an investment services firm to complete a merger with a financially sound company. Sometimes, investors create publicly traded companies whose major assets would be cash holdings and search for investment opportunities, including a merger with a privately held firm.

The over-the-counter market of publicly traded shells may have received a boost from the SEC's passing of the "eligibility rule," which was approved on January 4, 1999, and required all domestic over-the-counter firms to comply with filing requirements in place for exchange-listed firms. Careful study of OTC-listed firms' annual reports allows one to identify financially distressed companies, some of which openly declare their intention to merge with more successful businesses. Often shells self-advertise on the internet, whose growth substantially increased direct communications between companies and investors.

3.4. Sample Information and Variables Description

3.4.1. Data on Reverse Mergers and Classification of Deals

We extracted data on reverse mergers from the Thomson Financial – Securities Data Corporation Mergers and Acquisitions Database and obtained 999 observations for the 1995-2006 period. Our sample is constrained by this period because the U.S. Securities and Exchange Commission's Edgar database began keeping filings only in 1995, so the first year included in our sample is 1995[24].

Our search for reverse takeovers is restricted to U.S. firms. We collect data from the SEC Filings & Forms Edgar database to classify publicly traded firms as going concerns or companies in financial distress. We did not find Edgar data for 161 observations and omitted a further 75 observations in which one of the parties is a financial institution with SIC primary code 6000-6199, a unit investment trust with SIC code 6726, a trust with SIC codes from 6730 to 6733 or a REIT with SIC code 6798. After the elimination of 32 repetitive observations, we are left with a sample of 731 observations, of which 77 percent are Reverse Merger-IPOs.

We separated the population of reverse mergers into two categories based on whether the acquiring company in a reverse merger transaction was a going concern or was in financial distress, which explains the primary motivation of the private company in such a transaction - to go public or to expand its assets base through a regular acquisition. We classified companies that upgraded their status by going to a higher level exchange – for example, from the OTC market to Nasdaq – as a Reverse Merger-IPO if the firm being traded on the higher level

[24] We need access to S.E.C. filings to distinguish between RTO-IPOs and RTO-Takeovers.

trading floor was in distress prior to the announcement. Figures 3.2 and 3.3 show respectively 561 Reverse Merger-IPOs and 170 Reverse Merger-Takeovers in the 1995-2006 period in comparison with the number of IPOs and regular mergers.

Table 3.2 provides some of the descriptive statistics of the reverse merger firms covered by the Securities and Exchange Commission's Edgar database that are included in our sample. Financially distressed and over-the-counter firms are much smaller in size both prior to deal announcement and its completion, confirming that large established businesses go public through a regular IPO rather than through an RTO. Firms that engage in deals that we classified as reverse merger-takeover have a larger positive book value of equity.

We perform comparisons of RTO-IPOs, RTO-Takeovers and regular mergers to see if our classification properly takes into account the essence of reverse merger transactions. In reverse mergers, private firms acquire two types of assets: a public listing (or trading status in the case of over-the-counter traded firms) and the net assets of the company. We calculate the ratio of the firm market value[25] four weeks prior to deal announcement to the value of net assets of the publicly traded firm. If the resulting multiple is above 20, we set its value at 20 to mitigate the effects of outliers and possible data errors. We exclude observations with negative net assets from our tests. We exclude respectively 37 percent, 4 percent and 3 percent of observations with negative values from samples of reverse merger-IPOs, reverse merger-takeovers and regular mergers. Even though this exclusion introduces bias in our comparison of ratios for the three groups of transactions – we lower the actual premium paid to acquire firms with negative

[25] We obtained data on firm market value from the SDC Platinum database.

equity – the statistics line up as expected. Mean (median) of market value/net assets multiple for RTO-IPOs, RTO-Takeovers and regular mergers respectively equal 4.3 (1.7), 3.2 (1.8) and 3.0 (2.0). We observe that RTO-Takeover firms command a larger premium than firms acquired in regular mergers as evidenced by a comparison of the means[26]. The median value of calculated ratios is lower due to the exclusion of a large number of firms with negative equity value, for which, in fact, the premium to assets-in-place is the largest. We conclude that in reverse takeovers-IPOs new shareholders acquire firms with low asset value – mean equals $6.4 million – primarily to acquire their listing or publicly traded status, in the case of over-the-counter traded firms.

The mean value for the market value/net assets ratio for RTO-Takeovers is higher than for regular mergers, but the median is slightly lower. We conclude that RTO-Takeover transactions are similar to regular mergers and that assets acquired in RTO-Takeover deals are not cheaper than assets acquired in regular mergers.

3.4.2. Variables Description

In order to examine our timing hypothesis, we extracted data for mergers, Initial Public Offerings and Seasoned Equity Offerings from Securities Data Corporation (SDC) databases. For consistency, we eliminated firms with the SIC codes 6000-6199, 6726, 6730-6733 and 6798. We exclude reverse mergers from our sample of regular mergers. We extracted data on new listings from the Center

[26] Statistical tests show that the means are different at standard levels of significance, whereas medians are not.

for Research and Security Prices (CRSP) database by identifying new trading codes introduced by CRSP and eliminating those that succeed the codes of merging companies to avoid double counting. We obtain all data on stock performance from CRSP and Datastream and use Edgar to obtain data on operating performance prior to merger announcement and over a period of three years following the announcement/completion of the deal.

In order to assess impact of the dot com boom on the results of our study, we define technological firms using SIC codes 3571-3578, 3661-3679, 3812, 3823, 3825-3829, 3841-3845, 4812-4813, 4899, 7371-7379.

We estimate index-adjusted returns by subtracting the equally-weighted Nasdaq index return from the stocks' buy-and-hold return for the same period[27]. We examine returns beginning six months prior to the announcement date and follow the stocks for three years after the announcement and completion/withdrawal of the deal. We use profitability to assess a firm's operating performance. On an annual basis, profitability is estimated as profit/loss before taxes divided by year-end book asset value. We set the profitability measure equal to negative 100 percent for individual firm-years if the ratio falls below this level to mitigate the impact of outliers on our results. Final measures of profitability are averages for three-year periods or shorter periods of time for which financial reports are available.

[27] 188 reverse mergers that involve an Exchange-listed firm as one of the parties to the merger take place on Nasdaq and most of the firms in our sample are small-size firms, so the Nasdaq equally-weighted index fits our sample best.

3.5. Timing Issues

3.5.1. Correlation Analysis

We report annual and quarterly correlations separately for the two types of deals we defined earlier – RTO-IPOs and RTO-Takeovers – in tables 3.3 and 3.4. We observe that the correlations of reverse mergers classified as an alternative to regular IPOs with most measures of market activity are negative. On the other hand, correlation coefficients between reverse mergers classified as equivalent to regular takeovers are positive, following the same patterns as regular mergers.

We perform robustness checks using the book value of the assets of the acquiror – public company – prior to the deal announcement to separate reverse mergers used as an IPO alternative and those that are equivalent to regular takeovers. We use asset sizes of $1 million and $10 million as cut-offs to distinguish between RTO-IPOs and RTO-Takeovers. Out of a total of 698 firms for which asset size data are available, 356 firms have assets below $1 million and 529 have assets below $10 million. When a cut-off line of $10 million is used, we obtain virtually identical results as reported in tables 3.3 and 3.4: RTO firms with asset size $10 million and above exhibit the same timing patterns as Reverse Merger-Takeovers, whereas RTO firms with assets below $10 million follow the same timing as RTO-IPOs. With a cut-off line set at $1 million, correlations for smaller firms are similar to those reported for RTO-IPOs. Correlations for firms with assets above $1 million are not significant, except for the coefficient with regular mergers, which is significant at 1 and 2 percent levels with annual and quarterly data. We conclude that our classification of transactions is not incorrect

as evidenced by tests using asset size rather than the definition of company as either a going concern or a firm in distress prior to the merger to distinguish between the two types of transactions.

Figure 3.2 compares the frequency of Reverse Mergers – alternatives for IPOs – with that of Initial Public Offerings on an annual basis. We observe a sharp drop in the number of IPOs followed by an increase in the number of Reverse Merger-IPOs after 1999. Figure 3.3 compares the timing of regular mergers and takeovers structured as reverse mergers. We observe similar patterns for these two types of deals, confirming our initial assumption that RTO-IPOs should be studied separately from RTO-Takeovers. Next, we employ time series regression models to see if changes in the number of reverse mergers can be explained by various proxies for capital demands, information asymmetry, investor sentiment and current macroeconomic conditions.

3.5.2. Time Series Tests

Lowry (2003) shows that the IPO volume is highly persistent over time and scales the number of IPOs by the total number of public firms at the end of the prior period. We follow the same methodology to account for possible nonstationarity and divide the number of reverse mergers in both categories of deals by the number of public firms included in Compustat at the end of the previous period. Our sample covers the period 1995-2006, so we can not employ annual regressions and instead derive our conclusions from models that rely on quarterly data.

Table 3.6 shows results of time-series regressions for Reverse Merger-IPOs and Reverse Merger-Takeovers. Changes in quarterly volume of RTO-IPO are negatively related to future investment growth and positively related to changes in abnormal return dispersion around earnings announcement over three quarters preceding the announcement date. We conclude that more RTO-IPOs take place when demand for capital is low and information asymmetries are high. In models with RTO-Takeovers, future investment growth and past investment growth are positive and significant. The earnings dispersion variable is negative and significant, suggesting that more mergers take place when information asymmetry in the market is lower. Market-to-book ratio in the preceding quarter is positive and significant, providing further evidence that firms engage in mergers when market valuations are high. Future market returns are negative, confirming that managers of merging firms engage in market timing.

Earlier, we reported that RTO-IPOs are negatively correlated with Initial Public Offerings, whereas RTO-Takeovers are positively correlated with regular mergers. We test whether our models reported in table 3.6 are properly specified using the same variables to explain fluctuations in the quarterly volume of classic IPOs and regular mergers. Results are reported in table 3.7. We leave out a regulation dummy, because Nasdaq's decision to require public firms to comply with initial listing standards could not have an impact on market for IPOs and regular mergers[28]. We deflate the number of IPO firms in each quarter by the

[28] Introduction of a regulation dummy into regression models with IPOs and regular mergers has no material impact on the reported results. However, the fact that the variable attains siginificance is confusing because it appears to capture changes in macroeconomic and market environment in

number of exchange-listed firms rather than all public firms reported in Compustat, which we used to scale the reverse merger time series and which includes over-the-counter traded firms. Instead of the equally-weighted Nasdaq index, we employ the equally-weighted NYSE/Amex/Nasdaq index from the CRSP database.[29]

We find that the investment growth variable is significant in most specifications. We document a positive association between the IPO volume and future and past investment growth. Mergers are positively related to investment growth in model with capital demand proxies. They are also positively related to market-to-book ratio, suggesting that more mergers take place when market valuations are high. Information asymmetry variables in our specifications are not significant, but this is largely in line with Lowry's (2003) findings. Overall, our models are similar to models reported in Lowry (2003) to explain fluctuations in the number of Initial Public Offerings.

Our time series tests suggest that the explosive growth of RTO-IPOs in the period following the tech bubble burst can not be attributed to Nasdaq's decision to require reverse merger firms to comply with initial listing standards as of March 2001. The fluctuation in the quarterly number of RTO-IPOs and RTO-Takeovers is in large part caused by cyclical factors, which also drove down the number of initial public offerings, seasoned equity offerings, mergers and new

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regression models with IPOs and regular mergers and therefore does not serve its original purpose – to track down impact of changes in regulation of the reverse takeovers.

[29] We make an index change because Initial Public Offerings and regular mergers take place on all three exchanges, including NYSE, Amex and Nasdaq, and index that tracks stocks listed on three exchanges closer matches the composition of the IPO and merger samples. Only 14 percent of RTOs in our sample take place on NYSE and Amex. Remaining 86 percent involve firms listed on Nasdaq or traded over-the-counter and Pink Sheets, so Nasdaq index is a better match for RTO firms than NYSE/Amex/Nasdaq from CRSP database.

listings on exchanges in 2001-2006. Excluding banking and REIT transactions, the number of regular mergers declined by 26 percent in 2002-2006 compared to the 1995-1999 period, while Initial Public Offerings dropped 72 percent over the same period. This downturn in the business cycle opened room for companies searching for alternative sources of financing in 2001-2005. However, a pick-up in the stock market indices, the number of IPOs, SEOs and mergers in 2006 is followed by a decline in the volume of reverse merger-IPOs and an increase in the volume of reverse merger-takeovers (see table 3.1).

3.5.3. Stock Market Returns and Reverse Mergers Volume

Table 3.8 presents estimated results of models in which index returns prior to and following the announcement of reverse mergers are regressed on the number of RTO-IPOs and RTO-Takeovers in each quarter for 1995-2006[30]. There is no statistical significance in the models that employ equally-weighted indices, but models that use value-weighted indices suggest that RTO-IPOs take place when investor sentiment is low[31]. These results provide mild evidence of timing in the market for reverse mergers used as an alternative to Initial Public Offerings.

We do not find statistical significance in models in which stock market returns are regressed on the number of RTO-Takeovers. We check if regular mergers follow the same pattern by regressing quarterly and annual returns of the NYSE/Amex/Nasdaq index on the number of regular mergers, scaled by the

[30] For consistency, we divide the number of RTO-IPOs and RTO-Takeoves by the number of public firms at the end of the previous quarter.

[31] Results suggest that investor sentiment is more affected by the performance of larger firms, which are more heavily represented in the value-weighted index, than by the performance of smaller companies.

number of publicly traded firms at the end of the previous quarter. We observe statistical significance in models, in which the dependent variable is a value-weighted index in the quarter and year preceding the announcement, but not following it. There are several possible explanations why we do not observe statistical significance in models with reverse merger-takeovers. First, our subsample of RTO-Takeovers includes only 170 observations spread over 48 quarterly time periods, so the fluctuation in volume is not very high, which is confirmed by data from table 3.1 and figure 3.3. Second, our classification of reverse mergers into RTO-IPOs and RTO-Takeovers could contain some minor flaws even though the results of most tests strongly suggest it is accurate. Finally, we can not entirely rule out the possibility that in some transactions classified as RTO-Takeovers, the public status of one of the merger participants is one of the drivers of the merger.

Based on the results of our time series analysis and analysis of market returns prior to and after the merger announcement, we conclude that timing is present in the market for RTO-IPOs and RTO-Takeovers. In passing, we will mention that our results lend support to both neoclassical and behavioural explanations of timing and clustering in transactions that we classify as alternatives to classic IPOs and regular mergers. RTO-IPOs are negatively related to future investment growth and measures of information asymmetry. RTO-Takeovers are positively related to future and past investment growth and negatively related to information asymmetry proxies. A detailed analysis that allows to differentiate between

behavioural and neoclassical explanations of timing and/or clustering of reverse mergers is beyond the scope of this study.

3.6. Regulatory Effects

We examine characteristics of firms announcing reverse mergers and their performance over three periods – 1995 to 1999, 2000-2001 and 2002 to 2005 – and observe a decline in performance across almost all categories for reverse mergers-IPOs in 2000-2001 (results available upon request). Therefore, at the time of the intervention Nasdaq's move to tighten rules for reverse merger firms in March 2001 appeared to be well justified.

Following the Nasdaq market crash in 2000 and the tightening of listing requirements for reverse merger firms in 2001, we document a sharp drop in number of RTO-IPOs on exchanges and an explosive growth of reverse mergers-IPOs over-the-counter. Table 3.5 reports the average annual number of transactions by type of deal and trading floor in 1995-1999 and 2002-2006.[32] We observe a decline in the number of reverse takeovers with non-going concerns on the over-the-counter market following the SEC's decision to close loopholes for shell companies in 2005, but at this point we are unable to clearly differentiate whether this downturn is a result of a regulatory intervention or an up-tick in business cycle activity. We observe stricter enforcement of rules on Nasdaq as evidenced by larger number of involuntary delistings in 2001-2005 on Nasdaq, which increased the supply of potential RTO participants on the over-the-counter

[32] Growth of the RTO-IPO market after year 2000 is not driven by an increase in the number of defunct high-tech firms. The share of technological firms participating in reverse mergers in 2000-2006 is not higher than in 1995-1999.

market (data on the number of delisted firms and the reasons for delisting are available upon request).

In practical terms, a four-fold decline of reverse takeovers with financially distressed firms listed on exchanges (see table 3.5) implies that reverse mergers are no longer an alternative to classic Initial Public Offerings as inclusion into the over-the-counter market is not considered an IPO even though it provides access to public capital markets. Nasdaq's Over-The-Counter Bulletin Board (OTCBB) website says that its companies are not considered to be "listed" as "there is no listing agreement between either the OTCBB or Nasdaq and the issuer" and "there are no listing requirements that must be met by an OTCBB issuer. Accordingly, there are no financial requirements and there is no minimum bid price requirement." [33]

In the next two subsections, we examine whether exchange-listed firms are of higher quality than firms traded over-the-counter. We focus on two dimensions of firm quality: information asymmetry in the market for their stock and performance characteristics. Evidence that exchange-listed firms are of higher quality would lead us to conclude that Nasdaq-initiated regulatory changes had a negative effect on the reverse mergers market.

3.6.1. Information Asymmetry Tests

Insiders in firms engaging in reverse mergers have more opportunities to sell shares since they are not constrained by lock-up provisions typical for Initial Public Offerings. In IPOs, executive officers, directors, major shareholders are

[33] See http://www.otcbb.com/faqs/otcbb_faq.stm#Listing

prohibited from selling their stock within a pre-specified period of time, usually within 180 days of the IPO. There are no such restrictions in reverse mergers. In 67 percent of all transactions included in our sample, stocks of reverse merger firms have positive raw returns within the six-month window on both sides of the announcement date, providing existing shareholders of public firms with an opportunity to cash out.

Gleason et al (2005) document significant wealth gains upon announcement with higher returns for financially stronger firms. We examine stock returns over six-month, two-month, one-month, and five-day periods ending one day before the announcement date. Table 3.9a reports stock returns over a six-month period (data for other periods is available upon request). We report returns based on closing price or average between bid and ask price and, separately, returns calculated using closing price on the first day with non-zero trading volume. We observe that over-the-counter traded RTO-IPOs exhibit higher price run-ups, but only one of the four statistics for difference in means and medians - difference in means of returns based on first day with non-zero trading volume - is significant.

Regression models reported in table 3.10 suggest that exchange listing is associated with lower pre-announcement price run-ups, but the exchange listing indicator variable loses statistical significance when we control for firm size at the time of the announcement. In a model with pre-announcement stock returns based on the closing price on the first day with non-zero trading volume, the size variable (logarithm of assets) and the exchange listing render each other insignificant. The t-statistic on the exchange variable is slightly larger than that on

the size variable, but we can not conclude that exchange listing by itself leads to lower abnormal pre-announcement price returns.

We conclude that abnormal price returns prior to deal announcement are smaller on regulated trading floors, but this result may be attributed to firm size rather than the effect of listing on the exchange.

3.6.2. Performance of Reverse Merger Firms

Firm characteristics and performance measures differ by trading floor and type of deal. Results reported in table 3.9b suggest that all categories of firms are poor performers, which justifies the common perception of reverse mergers as transactions chosen by low-quality firms compared to IPOs chosen by high-quality firms. For example, exchange-listed firms that engage in Reverse Merger-Takeovers are the best performers in our sample, but their median index-adjusted return is negative 67 percent over three-year period after the deal announcement. Only 13 percent of reverse merger firms provide positive raw returns three years after the announcement date, in sharp contrast with the IPO firms. Ritter (1991) reports that more than 40 percent of the IPOs provide positive three-year raw returns, exclusive of the initial return. Results reported for RTO firms are somewhat consistent with Agrawal et al (1992), who show that post-acquisition returns are lower for stock-financed acquisitions - a category of deals that includes reverse mergers - than for cash-financed acquisitions.

We observe that exchange-listed firms are more profitable in the three-year period following the deal announcement, have a relatively higher probability of

continuing as a going concern and have less negative returns three years after deal completion. Regression models reported in table 3.10 lead to the same conclusions. The exchange indicator variable is positive and significant in three out of five models that measure firm performances. Gleason et al (2005) document that firms' financial condition prior to deal announcement is critical for their survival after completion of announced reverse mergers. We confirm this result using a logistic model with a going concern dummy as dependent variable.

We document that exchange-listed RTO firms are better performers than over-the-counter traded RTO firms. Earlier, we showed that stocks of exchange-listed firms are less affected by information asymmetries, although this result is in part due to the size effect. We conclude that Nasdaq's decision to require RTO firms to comply with initial listing standards beginning in March 2001 had a broad negative impact on the reverse mergers market. Nasdaq may have increased the quality of listed firms by preventing poor performers from getting access to its trading floor, but it pushed RTO firms into a more opaque and less regulated market.

3.7. Conclusion

This paper examines timing and changes in the composition of the market for reverse mergers in the 1995-2006 period. We contribute to the vast body of financial literature that suggests that firm managers strategically time corporate finance events to exploit market inefficiencies (Baker and Wurgler (2000), Burch et al (2004)), and we establish that two types of reverse mergers follow different

timing patterns. Small-size firms use over-the-counter traded distressed firms as vehicles to go public when IPO windows are closed and most measures of business activity and stock markets are on the decline. On the other hand, private firms take control of public companies that qualify as going concerns in reverse takeovers when market conditions are favorable. RTO-Takeovers are pro-cyclical to regular merger waves.

In addition, we establish that there are negative effects from regulatory interference that contributed to the migration of reverse mergers transactions to a less regulated market that hosts lower quality firms. We document that the over-the-counter market became the main venue for reverse mergers following the external shock caused by the tech bubble crash in 2000 and subsequent regulatory intervention on Nasdaq and other exchanges. This migration is yet another piece of evidence that more regulation may result in "crowding out" effects described in prior studies (Jarrell (1981); Bushee and Leuz (2005)). Since over-the-counter trading does not qualify as listing and requirements for admission to trading on the OTCBB are very low, we conclude that reverse mergers can no longer be considered an alternative to a classic Initial Public Offering. We conclude that Nasdaq's decision had negative effects on capital markets as a whole even though this decision probably increased the quality of listed firms on exchanges.

3.8. References

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Table 3.1.: Annual Volume of Reverse Mergers, 1995-2006

The table provides data on reverse mergers classified by type - Reverse Merger-IPO and Reverse Merger-Takeover - and trading floor - over-the-counter and exchanges - reported on an annual basis for 1995-2006 period. Deals with financial institutions/REITs and repetitive observations are excluded.

Year	Reverse Merger-IPO on Over-The-Counter Market	Reverse Merger-IPO on NYSE/AMEX/Nasdaq	Reverse Merger-Takeover on Over-The-Counter Market	Reverse Merger-Takeover on NYSE/AMEX/Nasdaq
1995	14	5	5	9
1996	18	6	4	16
1997	19	13	4	17
1998	12	12	4	14
1999	23	18	0	18
2000	61	12	2	13
2001	78	10	0	9
2002	63	5	1	8
2003	49	0	1	5
2004	45	3	3	5
2005	56	4	5	8
2006	32	3	6	13
Total	470	91	35	135

Table 3.2.: Descriptive Statistics for Reverse Merger Firms

Selected characteristics for firms announcing reverse takeover: comparison by trading floor and type of deal. Repetitive observations and transactions with banks and REITs excluded. The data are based on 1995-2006. P-values reported for t-test for the means, Fisher's exact test for categorical data and Wilcoxon rank-sum test for medians. ***,**,* represents significance at 1%, 5% and 10% levels, respectively

	Over-The-Counter			NYSE/Amex/Nasdaq					
	No	Mean	Median	No	Mean	Median		P-value for T-test for Means	P-value for Z-Test for Medians
Assets, $mln, prior to announcement	452	1.48	0.06	90	10.89	6.44	Reverse	0.00***	0.00***
Assets, $ mln, after completion	350	6.69	1.88	50	32.78	12.50	Merger	0.00***	0.00***
Retained earnings/deficit	452	-8.85	-1.64	89	-23.51	-11.56	-	0.00***	0.00***
Book equity	447	-0.26	-0.01	90	5.28	2.77	IPO	0.00***	0.00***
Percentage of completed deals	468	78.85%		92	55.43%			0.00***	
Assets, $mln, prior to announcement	28	295.91	12.20	128	1263.93	124.74	Reverse	0.00***	0.00***
Assets, $ mln, after completion	21	592.70	21.67	110	2144.72	215.06	Merger	0.10	0.00***
Retained earnings/deficit	26	-26.00	-1.02	113	48.81	-0.60	-	0.16	0.69
Book equity	27	91.04	6.70	121	314.01	51.30	Takeover	0.00***	0.00***
Percentage of completed deals	34	70.59%		134	82.09%			0.14	

	P-value for T-test for Means*	P-value for Z-Test for Medians	P-value for T-test for Means*	P-value for Z-Test for Medians
Assets, $mln, prior to announcement	0.09*	0.00***	0.00***	0.00***
Assets, $ mln, after completion	0.24	0.00***	0.01**	0.00***
Retained earnings/deficit	0.49	0.69	0.13	0.00***
Book equity	0.09*	0.00***	0.00***	0.00***
Percentage of completed deals	0.26		0.00***	

*Fisher's Exact test for categorical data applied to proportions

Table 3.3.: Annual Correlations between the Number of Reverse Mergers and Measures of Market Activity

The table shows annual correlations for reverse mergers classified as alternative to IPOs, reverse mergers classified as equivalent of regular mergers, IPOs, SEOs, listings on three major U.S. exchanges, announced mergers and annual contamporaneous Nasdaq equally-weighted index return. Data are for 1995-2006. Transactions with banks, REITs and repetitive observations excluded. P-values for t-statistics are reported under correlation coefficients. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Reverse Merger-IPO, t	1.00						
2	Reverse Merger-Takeover, t	-0.60**	1.00					
3	IPOs, t	-0.64**	0.75***	1.00				
4	SEOs, t	-0.71***	0.49*	0.83***	1.00			
5	Listings, t	-0.64**	0.80***	0.98***	0.82***	1.00		
6	Mergers, t	-0.59**	0.86***	0.69**	0.41	0.73***	1.00	
7	Equally-weighted Nasdaq, t	-0.21	-0.28	-0.06	0.13	-0.18	-0.22	1.00

Table 3.4.: Quarterly Correlations between Reverse Mergers and Measures of Market Activity

The table shows quarterly correlations for reverse mergers classified as alternative to IPOs, reverse mergers classified as equivalent of regular mergers, IPOs, SEOs, announced mergers, listings on three major U.S. exchanges and quarterly contamporaneous Nasdaq equally-weighted index returns. Data are for 1995-2006. Transactions with banks, REITs and repetitive observations excluded. P-values for t-statistics are reported under correlation coefficients. ***,**,* represent significance at 1%, 5% and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 RTO-IPO	1.00						
2 RTO-Merger	-0.27*	1.00					
3 IPO	-0.51***	0.41***	1.00				
4 SEO	-0.38***	0.23	0.68***	1.00			
5 Listings	-0.53***	0.43***	0.97***	0.64***	1.00		
6 Merger	-0.53***	0.38***	0.62***	0.28*	0.63***	1.00	
7 EW market return, t	-0.10	-0.07	0.03	0.24*	-0.27*	-0.13	1.00

Table 3.5.: Average Annual Number of Reverse Mergers by Type and Trading Floor in 1995-1999 and 2002-2006

The table shows the average annual number of Reverse Merger-IPOs and Reverse Merger-Takeovers before and after the Nasdaq market crash in 2000 and Nasdaq/S.E.C.'s decision to require reverse merger firms to comply with initial standards instead of continuing listing rules in March 2001. Numbers rounded to the nearest integer. Transactions with banks and REITs are excluded.

Period	Reverse Merger-IPO on Over-The-Counter Market	Reverse Merger-IPO on Exchanges	Reverse Merger-Takeover on Over-The-Counter Market	Reverse Merger-Takeover on Exchanges
1995-1999	17	11	3	15
2002-2006	49	3	3	8

Table 3.6.: Quarterly Time Series of Reverse Mergers Volume in 1995-2006

The table presents quarterly regressions, in which the dependent variables are the number of reverse mergers, deflated by the number of number of public firms in Compustat (in thousands) at the end of the prior quarter. In models 1, 2, 3 and 4, the dependent variable is number of reverse mergers classified as an alternative to Initial Public Offerings. In models 5, 6, 7 and 8, the dependent variable is the number of reverse mergers classified as equivalent to regular mergers. The data are for 1995-2006. Future sales growth equals the log of real sales in quarter (t+3) minus the log of real sales in quarter (t-1). Past sales growth equals the log of real sales in quarter (t-1) minus the log of real sales in quarter (t-5). Data on sales – total manufacturing and trade sales - is extracted from Economic Indicators (monthly publication) of the Council of Economic Advisers and adjusted for inflation. Investment growth is the percentage change in real quarterly private nonresidential investment between quarter (t-4) and quarter (t-1) and between quarter t and quarter (t+3). The NBER dummy equals one if quarter (t+1) is an expansion and zero otherwise. The dispersion of abnormal returns around earnings announcements equals the standard deviation across all firms with earnings announcements in a given quarter calculated over (-1,+1) days around the announcement date. Analyst dispersion is the average, across all companies that are in the last quarter of their fiscal year and have analyst forecasts listed on IBES during a given quarter, of the standard deviation of analyst forecasts for each company. The change in each of these dispersion measures equals the dispersion in quarter (t-1) minus the dispersion in quarter (t-4). Past and future market returns are calculated as compounded quarterly Nasdaq equally-weighted returns between quarter (t-4) and quarter (t-1) and between quarter t and quarter (t+3). The market-wide market-to-book ratio is defined as the equally weighted average across all public firms of individual firm market value of equity divided by book value (total shareholders equity - preferred stock + deferred taxes + investment tax credits), where book value is lagged by two quarters relative to market value. The market-to-book ratio is based on all public firms included in Compustat at the end of the previous quarter. Regulation dummy equals one for all time periods beginning with the second quarter of 2001, when the S.E.C. required public firms that engage in reverse merger transactions to comply with initial listing requirements. Subscripts (t, t+1, t+3, etc) refer to data at the end of corresponding quarter. Transactions with banks and REITs are excluded. All estimates are adjusted for serial correlation and heteroskedasticity using the Newey-West procedure. ***, **, * represent significance at 1%, 5% and 10% level, respectively.

	Reverse Merger - IPOs			
	(1) Cap demands	(2) Info asymmetry	(3) All proxies	(4) Macro conditions
Intercept	1.30***	0.23**	0.93**	0.28
Future sales growth, (t-1) to (t+3)	-0.87			
Future GDP growth, t to (t+3)	2.69		0.46	
Future investment growth, t to (t+3)	-5.10***		-6.21***	
NBER, (t+1)	-0.46*			
Earnings abnormal reaction dispersion, (t-4) to (t-1)		2.44**	1.00	
Earnings forecast dispersion, (t-4) to (t-1)		0.00	0.00	
EW market return, t to (t+3)			0.01	
Market-to-book ratio, (t-1)			-0.00	
EW market return, (t-4) to (t-1)			0.27	
Past sales growth, (t-5) to (t-1)				-0.02
Past GDP growth, (t-4) to (t-1)				2.00
Past investment growth, (t-4) to (t-1)				-0.98
Regulation	0.42**	0.12	0.28**	0.09
AR (1)	0.16	0.75***	0.22	0.70***
Adjusted R-squared	72.34%	61.86%	72.16%	58.81%
No. of observations	47	47	47	47

Table 3.6 (continued)

	Reverse Merger - Takeovers			
	(5) Cap demands	(6) Info asymmetry	(7) All proxies	(8) Macro conditions
Intercept	0.55***	0.40***	0.59***	0.40***
Future sales growth, (t-1) to (t+3)	1.83			
Future GDP growth, t to (t+3)	-6.59		-6.80	
Future investment growth, t to (t+3)	1.18		2.56**	
NBER, (t+1)	0.03			
Earnings abnormal reaction dispersion, (t-4) to (t-1)		-1.38*	-0.63	
Earnings forecast dispersion, (t-4) to (t-1)		0.00	0.00	
EW market return, t to (t+3)			-0.14	
Market-to-book ratio, (t-1)			0.001**	
EW market return, (t-4) to (t-1)			-0.30**	
Past sales growth, (t-5) to (t-1)				-2.98
Past GDP growth, (t-4) to (t-1)				-2.33
Past investment growth, (t-4) to (t-1)				2.84***
Regulation	-0.15	-0.12*	-0.10	0.00
AR (1)	-0.07	0.00	-0.11	-0.12
Adjusted R-squared	2.49%	7.76%	14.62%	12.22%
No. of observations	47	47	47	47

Table 3.7.:

Quarterly Time Series of Initial Public Offerings and Mergers Volume in 1995-2006

The table presents quarterly regressions, in which the dependent variables are the number of initial public offerings, deflated by the number of exchange-listed firms in (in hundreds), and regular mergers deflated by the number of exchange-listed firms at the end of the prior quarter. In models 1, 2, 3 and 4, the dependent variable is number of Initial Public Offerings. In models 5, 6, 7 and 8, the dependent variable is the number of announced regular mergers. The data are based on 1995-2006. Future sales growth equals the log of real sales in quarter (t+3) minus the log of real sales in quarter (t-1). Past sales growth equals the log of real sales in quarter (t-1) minus the log of real sales in quarter (t-5). Data on sales – total manufacturing and trade sales - is extracted from Economic Indicators (monthly publication) of the Council of Economic Advisers and adjusted for inflation. Investment growth is the percentage change in real quarterly private nonresidential investment between quarter (t-4) and quarter (t-1) and between quarter t and quarter (t+3). The NBER dummy equals one if quarter (t+1) is an expansion and zero otherwise. The dispersion of abnormal returns around earnings announcements equals the standard deviation across all firms with earnings announcements in a given quarter calculated over (-1,+1) days around the announcement date. Analyst dispersion is the average, across all companies that are in the last quarter of their fiscal year and have analyst forecasts listed on IBES during a given quarter, of the standard deviation of analyst forecasts for each company. The change in each of these dispersion measures equals the dispersion in quarter (t-1) minus the dispersion in quarter (t-4). Past and future market returns are calculated as compounded quarterly NYSE/Amex/Nasdaq equally-weighted returns between quarter (t-4) and quarter (t-1) and between quarter t and quarter (t+3). The market-wide market-to-book ratio is defined as the equally weighted average across all exchange-listed firms of individual firm market value of equity divided by book value (total shareholders equity - preferred stock + deferred taxes + investment tax credits), where book value is lagged by two quarters relative to market value. The market-to-book ratio is based on all echange-listed firms included in CRSP at the end of the previous quarter. Regulation dummy equals one for all time periods beginning with the second quarter of 2001, when the S.E.C. required public firms that engage in reverse merger transactions to comply with initial listing requirements. Subscripts (t, t+1, t+3, etc) refer to data at the end of corresponding quarter. Transactions with banks and REITs are excluded. All estimates are adjusted for serial correlation and heteroskedasticity using the Newey-West procedure. ***, **,* represent significance at 1%, 5% and 10% level, respectively.

	IPOs			
	(1) Cap demands	(2) Info asymmetry	(3) All proxies	(4) Macro conditions
Intercept	0.42	0.24***	0.36*	0.21
Future sales growth, (t-1) to (t+3)	-2.15			
Future GDP growth, t to (t+3)	0.20		1.99	
Future investment growth, t to (t+3)	4.57**		3.36*	
NBER, (t+1)	-0.15			
Earnings abnormal reaction dispersion, (t-4) to (t-1)		-0.86	-0.13	
Earnings forecast dispersion, (t-4) to (t-1)		0.00	0.00	
EW market return, t to (t+3)			-0.65	
Market-to-book ratio, (t-1)			-0.02	
EW market return, (t-4) to (t-1)			0.21	
Past sales growth, (t-5) to (t-1)				-8.01
Past GDP growth, (t-4) to (t-1)				2.02
Past investment growth, (t-4) to (t-1)				8.51***
AR (1)	0.53***	0.73***	0.56***	0.58***
Adjusted R-squared	55.36%	50.74%	55.31%	56.93%
No. of observations	47	47	47	47

Table 3.7 (continued)

	Regular Mergers			
	(5) Cap demands	(6) Info asymmetry	(7) All proxies	(8) Macro conditions
Intercept	0.08*	0.04	0.07*	0.07**
Future sales growth, (t-1) to (t+3)	0.23			
Future GDP growth, t to (t+3)	0.56		-0.23	
Future investment growth, t to (t+3)	0.24**		0.24	
NBER, (t+1)	0.00			
Earnings abnormal reaction dispersion, (t-4) to (t-1)		-0.10	-0.04	
Earnings forecast dispersion, (t-4) to (t-1)		-0.00	0.00	
EW market return, t to (t+3)			0.01	
Market-to-book ratio, (t-1)			0.002*	
EW market return, (t-4) to (t-1)			0.01	
Past sales growth, (t-5) to (t-1)				0.58
Past GDP growth, (t-4) to (t-1)				0.29
Past investment growth, (t-4) to (t-1)				0.31
AR (1)	0.72***	0.85***	0.68***	0.68***
Adjusted R-squared	71.37%	67.38%	70.70%	69.98%
No. of observations	47	47	47	47

Table 3.8.: Regressions of Market Returns on Volume of Reverse Mergers-IPOs and Volume of Reverse Mergers-Takeovers

The table shows regressions of Nasdaq market returns on RTO-IPO volume in 1995-2006. The dependent variables are equally-weighted and value-weighted Nasdaq market returns, including dividend distributions and payouts, in the quarter and over four quarters prior to and following the quarter in which the reverse merger is announced. The number of reverse mergers is divided by the number of public firms included in Compustat at the end of the previous quarter. All estimates are adjusted for serial correlation and heteroskedasticity using the Newey-West procedure. ***,**,* represent significance at 1%, 5% and 10% level, respectively.

Panel A. RTO-IPOs

Dependent variable	Intercept	RTO-IPO volume	Adj. R-squared	No. of Obs.
Panel A.1 EW market returns				
Quartely EW future market returns	0.10***	-0.03	0.92%	48
Quartely EW past market returns	0.05	-0.00	-2.17%	48
Annual EW future market returns	0.25***	-0.04	-1.02%	48
Annual EW past market returns	0.24**	-0.03	-1.64%	48
Panel A.2 VW market returns				
Quarterly VW future market returns	0.15***	-0.07**	12.19%	48
Quarterly VW past market returns	0.12***	-0.05**	5.26%	48
Annual VW future market returns	0.48***	-0.22***	28.11%	48
Annual VW past market returns	0.43***	-0.18**	17.38%	48

Panel B. RTO-Takeovers

Dependent variable	Intercept	RTO-Takeover volume	Adj. R-squared	No. of obs.
Panel B.1 EW market returns				
Quartely EW future market returns	0.07*	-0.05	-1.37%	48
Quartely EW past market returns	0.07	-0.05	-1.22%	48
Annual EW future market returns	0.26**	-0.17	2.05%	48
Annual EW past market returns	0.22	-0.06	-1.90%	48
Panel B.2 VW market returns				
Quarterly VW future market returns	0.06	-0.05	-1.28%	48
Quarterly VW past market returns	0.04	-0.02	-2.07%	48
Annual VW future market returns	0.10	0.08	-1.77%	48
Annual VW past market returns	0.08	0.15	-0.62%	48

Table 3.9a: Information Asymmetry and Performance Measures of Reverse Merger Firms

Panel A presents stock returns prior to announcement of reverse merger transactions. Returns for different types of deals - RTO-IPOs and RTO-Mergers - and different trading floors are reported for six-month period preceding the announcement of reverse merger transaction. All returns are abnormal returns, calculated as raw returns less Nasdaq equally-weighted index returns for the corresponding period. Volume-adjusted returns differ because they are based on prices on the first day with non-zero trading volume in the period for which returns are calculated. Observations for financial firms/REITs and repetitive observations are excluded. P-value for t-statistic and signed rank test reported below respective values for means and medians. ***,**,* represents significance at 1%, 5% and 10% levels, respectively.

	Over-The-Counter			NYSE/Amex/Nasdaq				P-value for T-test for means*	P-value for Z-Test for medians
	N. of Obs.	Mean	Median	N. of Obs.	Mean	Median			
6-month abnormal returns prior to deal announcement	309	1115.78%	-7.54%	92	31.46%	-17.41%	Reverse	0.26	0.36
6-month abnormal returns prior to deal announcement for firms with non-zero trading volume at the start of the period	196	137.06%	-0.60%	84	34.31%	-12.86%	Merger-IPO	0.01**	0.19
6-month abnormal returns prior to deal announcement	20	0.98%	0.18%	127	9.85%	2.37%	Reverse	0.56	0.66
6-month abnormal returns prior to deal announcement for firms with non-zero trading volume at the start of the period	15	3.08%	1.43%	129	8.33%	-0.28%	Merger-Takeover	0.76	0.79

	P-value for T-test for means*	P-value for Z-Test for medians	P-value for T-test for means*	P-value for Z-Test for medians
6-month abnormal returns prior to deal announcement	0.25	0.35	0.27	0.06*
6-month abnormal returns prior to deal announcement for firms with non-zero trading volume at the start of the period	0.00***	0.80	1.21	0.18

Table 3.9b: Information Asymmetry and Performance Measures of Reverse Merger Firms

Panel B of the table presents selected performance measures for firms announcing reverse takeovers: comparison by trading floor and type of deal. All returns are abnormal returns, calculated as raw returns less Nasdaq equally-weighted index returns for the corresponding period. Volume-adjusted returns differ because they are based on prices on the first day with non-zero trading volume in the period for which returns are calculated. Profitability is calculated as average of profit divided by assets over the first three years after deal announcement or less, if data for three years are not available. Profitability ratio is set at -100% for each individual firm-year if it is less than -100%. All returns are adjusted for returns of equally-weighted Nasdaq index over the corresponding period. Observations for financial firms/REITs and repetitive observations are excluded. P-values reported for t-test for the means, Fisher's exact test for categorical data and Wilcoxon rank-sum test for medians. ***,**,* represents significance at 1%, 5% and 10% levels, respectively.

	Over-The-Counter			NYSE/Amex/Nasdaq					
	N. of Obs.	Mean	Median	N. of Obs.	Mean	Median		T-test for means*	Z-Test for medians
Profitability over 3-year period	407	-60.76%	-68.25%	79	-31.08%	-25.90%	Reverse	0.00***	0.00***
Survival rate 3 years after announcement	435	28.05%		88	53.41%		Merger	0.00***	
3-year returns after deal announcement	277	366.64%	-105.11%	84	160.38%	-98.72%	-	0.67	0.31
3-year returns after deal completion	213	-29.62%	-111.08%	42	-47.42%	-88.38%	IPO	0.68	0.04**
3-year volume-adjusted returns after deal announcement	261	374.51%	-108.48%	84	149.92%	-98.72%		0.66	0.20
3-year volume-adjusted returns after deal completion	203	-92.03%	-113.06%	43	-47.71%	-88.02%		0.09*	0.01**
Profitability over 3-year period	28	-16.10%	-11.61%	121	-7.04%	-0.1%	Reverse	0.06*	0.01**
Survival rate 3 years after announcement	31	77.42%		130	87.69%		Merger	0.14	
3-year returns after deal announcement	12	-32.19%	-80.48%	112	-41.12%	-66.51%	-	0.81	1.00
3-year returns after deal completion	9	-61.52%	-110.65%	91	-39.33%	-50.50%	Takeover	0.48	0.73
3-year volume-adjusted returns after deal announcement	12	-34.28%	-79.94%	112	-41.13%	-66.51%		0.86	1.00
3-year volume-adjusted returns after deal completion	10	-60.71%	-71.32%	91	-39.34%	-50.50%		0.47	0.97

	T-test for means*	Z-Test for medians	T-test for means*	Z-Test for medians
Profitability over 3-year period	0.00***	0.00***	0.00***	0.00***
Survival rate 3 years after announcement	0.00***		0.00***	
3-year returns after deal announcement	0.36	0.55	0.36	0.00***
3-year returns after deal completion	0.48	0.73	0.77	0.07*
3-year volume-adjusted returns after deal announcement	0.38	0.55	0.36	0.00***
3-year volume-adjusted returns after deal completion	0.34	0.51	0.75	0.10*

Table 3.10.: Regression Analysis of Information Asymmetries and Performances of Reverse Merger Firms

The table presents regressions in which the dependent variables are returns over six months prior to deal announcement, three-year period after a deal announcement/completion, profitability of companies announcing reverse mergers averaged over three-year period after announcement, and dummy variable that equals one if the firm qualifies as going concern three years after the deal announcement. All returns are abnormal returns that are equal to raw returns less Nasdaq equally-weighted index returns for the corresponding period. The size variable equals the logarithm of assets at the start of the corresponding period. Tech dummy equals one if a newly emerging firm is in the high-tech industry. The data are for 1995-2006. Transactions with banks and REITs and repetitive observations are excluded. T-statistics for regression coefficients and Wald Chi-square statistics for coefficients in logistic models are reported in brackets. ***,**,* represent significance at 1%, 5% and 10% level, respectively.

	Information asymmetry measures				Performance measures				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	6-month pre-announcement returns	6-month pre-announcement returns	6-month pre-announcement returns	6-month pre-announcement returns	3-year post-announcement returns	3-year post-announcement returns	3-year post-announcement returns	Profitability	Going concern
	Whole sample	Observations with non-zero trading volume			Whole sample	Observations with non-zero trading volume		Whole sample	Whole sample
Constant	0.75	0.71	0.69	0.35	2.46	-0.43	-0.89***	-0.45***	0.24
Size	-0.02	-0.06		-0.10*	0.50	0.09	0.04	0.06***	0.30***
Firm in distress at announcement	0.35	0.14	0.40	0.28	3.16	0.26	-0.02	-0.09**	-1.07***
Exchange listing at announcement	-0.83	-0.62	-0.97**		-4.83	-0.34	0.32*	0.11***	0.45*
Tech dummy	0.64	0.99**	1.06***	0.97**	-4.29	-0.51	-0.04	-0.12***	-0.18
Adjusted R-squared	1.07%	3.49%	3.93%	3.33%	-0.54%	-0.56%	5.04%	42.51%	
Wald Chi-Square									116.74***
No. of observations	486	359	384	359	461	446	333	594	610

Figure 3.1.: Total Number of Reverse Mergers in 1990-2006
Annual Data. The graph is based on 1,347 reverse mergers extracted from Thomson Financial - Securities Data Corporation Mergers and Acquisitions Database.

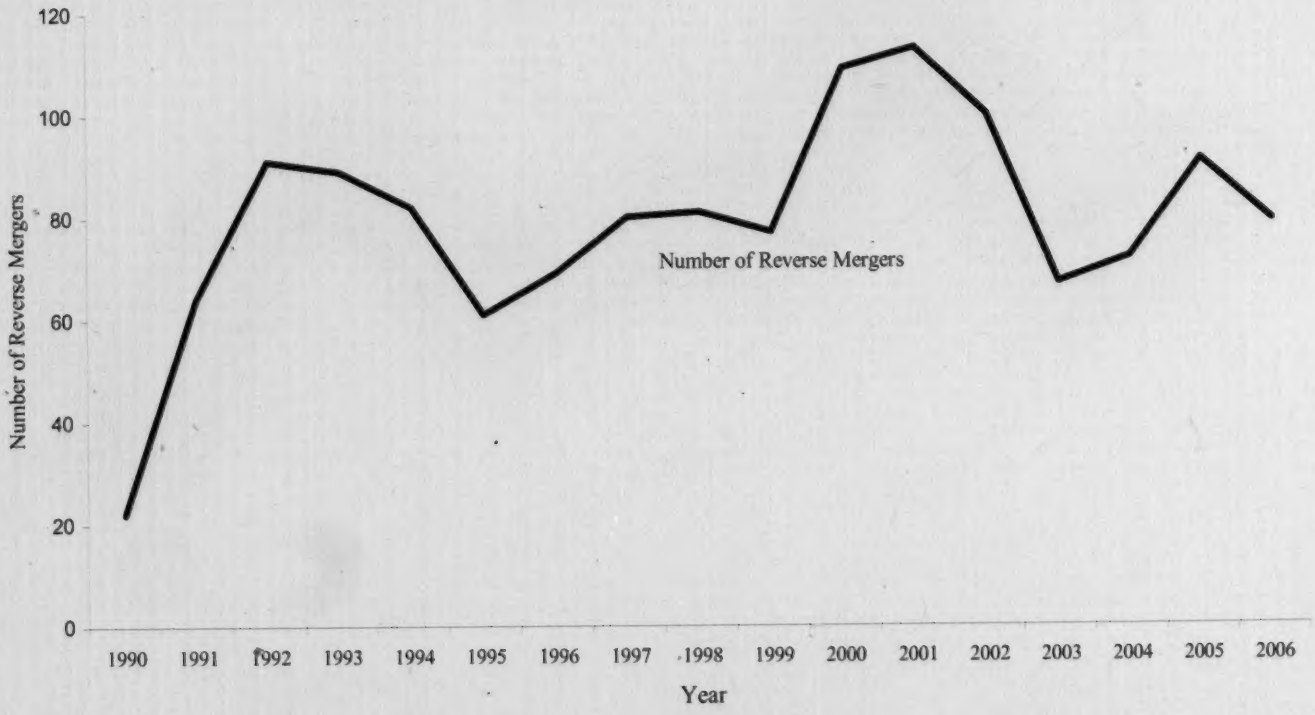


Figure 3.2.: Number of Initial Public Offerings and Reverse Merger-IPOs in 1995-2006
Annual data. Number of regular IPOs scaled by 10. Graph is based on 3,501 IPOs and 561 reverse merger-IPOs from the SDC database.

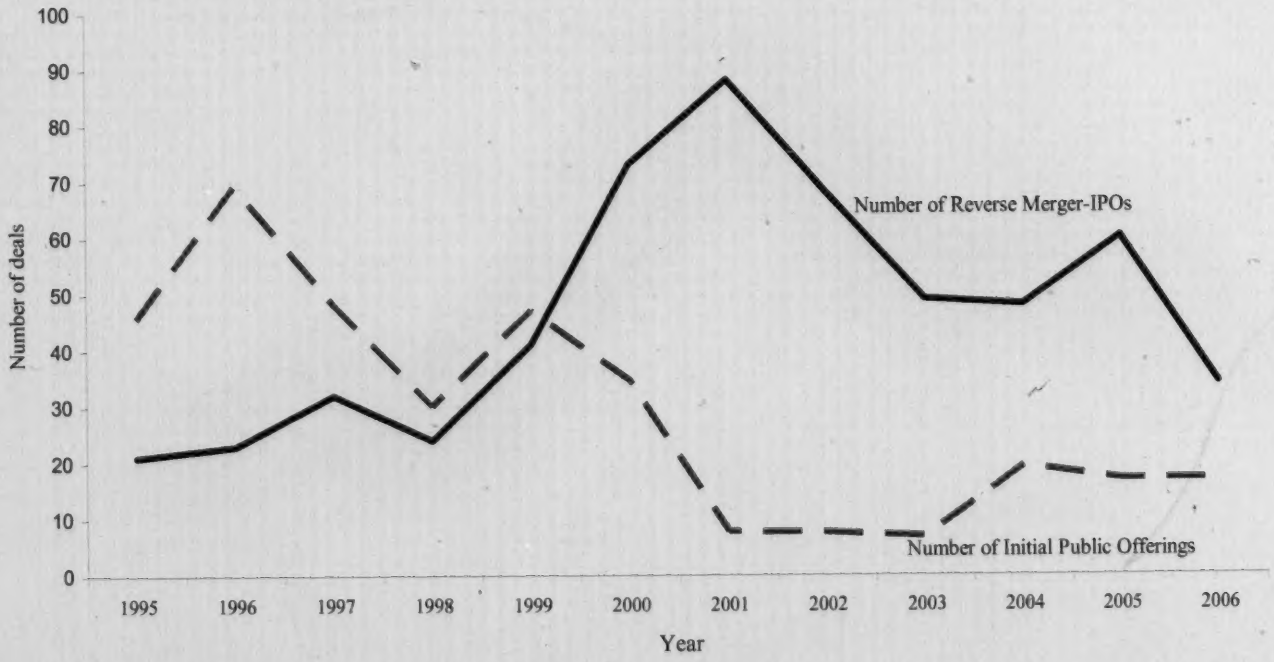
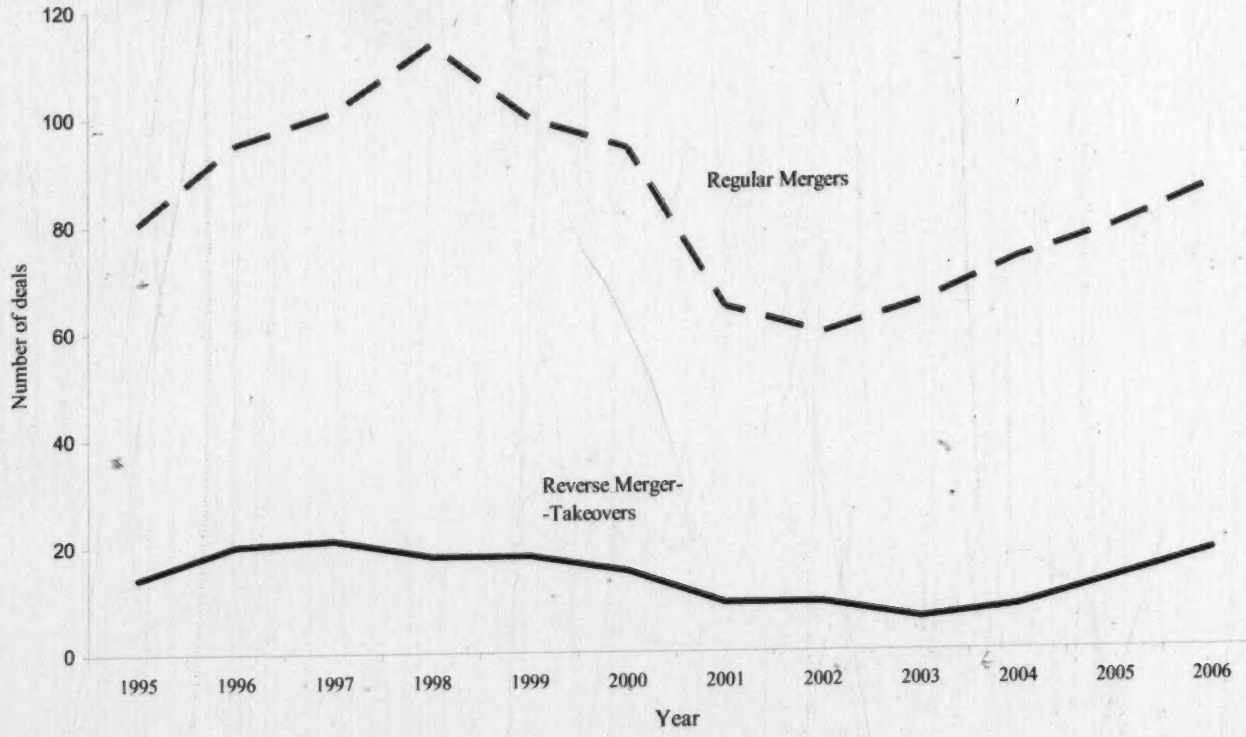


Figure 3.3.: Number of Announced Regular Mergers and Reverse Merger-Takeovers in 1995-2006
Annual data. Number of regular mergers is scaled by 100. Graph is based on 100,894 mergers and 170 reverse merger-takeovers from the SDC database.



4. Microstructure Analysis of Informed Trading in Tender Offers

4.1. Introduction

Insider trading actions in mergers and acquisitions have received considerable attention in the media, in the regulatory bodies, and in the academic community in the last two decades. Interest was sparked by the 1986 charges of insider trading against Dennis Levine, a managing director at Drexel Burnham Lambert. The academic literature is divided on the effects of insider trading on stock prices. Jarrell and Poulsen (1989) conclude that premiums and price runups before the announcement of tender offers are consistent with a legitimate market for information and are unrelated to insider trading. At the same time, using a sample of tender offers, Barclay and Warner (1993) develop a *stealth trading hypothesis* that shows that price movements in pre-announcement periods are a result of trading by informed investors. Our study provides another test of the stealth trading hypothesis versus the *public information hypothesis*.

The objective of this paper is to determine if informed investors exhibit strategic behaviour during tender offers. We relate the direction and magnitude of informed trades to the types of information that insiders could be trading on.

First, we test if, prior to announcements of tender offers, investors accumulate shares in medium-size trades, which previous research links to informed investors who camouflage their information by spreading trades over time (Barclay and Warner (2003), Lee and Ready (1991)). If order imbalances are positive in medium-size trades, but not in large- or small-size trades, or if buying pressure is larger in medium-size trades than in trades of other sizes, we will conclude that

informed trading takes place. Second, we examine if selling pressure is larger in medium-size trades in to-be-completed deals. Evidence of large selling pressure in medium-size trades supports the hypothesis that informed trading takes place in the post-announcement period.

Our results indicate that informed traders accumulate shares of target companies prior to announcements of friendly tender offers. Imbalances prior to announcement fail to predict the outcome of the tender offer because there is no leakage of information in hostile deals. After the announcement, a larger selling pressure in medium-size trades is associated with a higher probability of successful completion of the tender offer in both hostile and friendly deals. Order imbalances in medium-size trades have stronger statistical significance than measures of buying pressure in small- and large-size trades in all models; this suggests that in the post-announcement period informed investors also camouflage their trades, but the difference in predictive power is marginal. We resolve this apparent contradiction by showing that informed traders account for a small percentage of the free float that changes hands around announcement dates.

Our study looks beyond a connection between price changes and net buying pressure measured by order imbalances. We contribute to the existing literature by establishing a connection between types of private information that trigger selling or buying on behalf of informed investors. We show that informed investors act strategically and that the direction of their trades contains specific information about tender offers and their outcome.

Beyond the academic community, our findings should also be of interest to industry professionals and regulators. The result that order imbalances are related to specific non-public information implies that a large amount of private information becomes available to public investors, increasing the speed of price adjustments and leading to higher market efficiency.

The remainder of the paper is arranged as follows. In section 4.2 the theoretical motivation for our empirical tests is described. Data and variables are presented in section 4.3. Major findings are discussed in section 4.4, which also includes some robustness checks. Section 4.5 concludes the paper.

4.2. Research Questions

Our study builds on extensive research in the area of microstructure. Existing research suggests that medium-size trades contain more non-public information than trades of small or large size. Barclay and Warner (1993) examine a sample of 108 tender offers in the 1981-1984 period, and document that medium-size trades, which include 500-9,900 shares, are associated with 92.8 percent of price changes. Barclay and Warner (1993) find support for a stealth trading hypothesis, which postulates that medium-size trades contain more information than trades of other size, and reject the public information hypothesis, under which most stock-price changes are caused by public information releases. Chakravarty (2001) uses a sample of 97 stocks that had at least a five percent price increase over the three-month period from a sample of NYSE stocks in November 1990 to January 1991 to establish that price changes are caused primarily by medium-size trades

initiated by institutions. Cornell and Sirri (1992) examine results of insider trading prosecutions and show that 78 percent of insider trades are of medium size.

Our analysis focuses on informed investor behaviour, which we infer from order imbalances - measures of net buying pressure faced by market-makers - in medium-size trades. First, we examine the behaviour of investors in the pre-announcement period. If a tender offer is friendly, the probability of its success is high[34] and informed investors will choose to accumulate shares prior to the announcement date at prices below the announced acquisition price that usually contains a premium for corporate control. Informed investors from both the acquiror and the target companies will increase their holdings at the expense of noise traders.

In hostile takeovers, strategic behaviour of informed investors prior to the announcement is less predictable. First, target company managers may not be aware of the upcoming bid, so they remain uninformed and can not trade on private information. Secondly, the prospective acquiror may act in two different ways: increase the size of foothold to make the acquisition more likely, or abstain from trading because it can be left with a minority stake in the target firm if the offer is not successful. Most offers are conditional on the buyer acquiring a certain percentage of shares, so the acquiring firm is bound to purchase shares in announced tender offer only if a set threshold is met. If the acquiror buys a minority stake that is not part of a tender offer, the risk of trading losses arises if the acquisition does not go through. Golbe and Schranz (1994) show that bidding

[34] There is plenty of evidence of a positive relationship between friendly attitude and successful completion of tender offers in the academic literature, for example, in Walkling (1985). Results in our sample suggest the same.

firms have an incentive to tip arbitrageurs prior to the public announcement of a tender offer to alter the ownership structure of the target firm. Weston et al (1990) suggest that tendering costs of the bidder are lower if a large portion of the shares is in "friendly hands."

We expect to observe stock accumulation in friendly tender offers in medium-size trades in the pre-announcement period[35]. With respect to hostile deals, our prediction is more ambiguous. Positive direction of trades will provide evidence that bidders tip arbitrageurs. Negative or zero trade imbalances will confirm that no information is leaked prior to the announcement or that arbitrageurs or the bidding firm find it too risky to invest in deals whose outcome is uncertain.

Next, we test if completion or withdrawal of tender offers can be inferred from the direction and magnitude of trades. If medium-size trades are those of informed traders, we should be able to infer more information about the outcome of the tender offer from the direction of these trades. If a tender offer is accepted by the target company and is to be completed, informed traders should sell the stock after the announcement. If the company is not willing to accept an offer, we expect to observe weaker selling pressure or net buying of stock after the announcement.

One of the questions that merits attention in the context of our study is why informed investors camouflage their trades in the post-announcement period instead of selling large blocks of shares after the company management approves the deal. First, if informed traders are buying shares prior to the announcement,

[35] In the next section, we describe how we use a news-adjusted announcement date rather than the official announcement date for the purposes of our study.

they will not disclose their identity afterwards. Secondly, share voting agreements often used in friendly deals commit managers to tender the stake of shares they collectively own before expiration of the tender offer and allow the bidder to vote that stake if shareholders call for a meeting to vote on the merger proposal. Managers therefore can not sell their shares immediately. However, if there is any uncertainty with regards to the outcome of the deal, which, if it fails, would result in negative post-announcement returns, managers may resort to selling the stock short and later reimburse with proceeds from tendered shares or buy shares back in the market at lower price if the bid fails[36]. Third, informed investors that are bound by share voting agreements could be selling stock for liquidity purposes. Finally, sometimes prices overshoot the offer price following the announcement. This may appear puzzling, but if investors expect renegotiation of initial terms to take place, such an increase should be viewed as a result of a change in expectations rather than over-reaction. Informed investors will immediately sell the stock if the probability of renegotiating the deal on better terms is low. In summary, informed investors have reasons to spread their trades in the post-announcement period.

Formally, our hypotheses can be summarized as follows:

- Accumulation of stock prior to announcement takes place in medium-size trades, but not in other trades. If it occurs in trades of all sizes, there is a larger accumulation of stock in medium-size trades.
- Selling of stock in medium-size trades is heavier in the post-

[36] In our sample, the median abnormal return between the event data and date on which the tender offer is withdrawn, equals negative 15 percent in friendly deals and negative 10 percent in hostile or unsolicited deals.

announcement period for completed tender offers .

Our tests focus on these empirical predictions. If we find evidence of stock accumulation prior to the announcement and link between medium-size trades and deal completion, we will provide further support for stealth trading hypothesis as opposed to informed trading hypothesis.

4.3. Data and Variable Description

4.3.1. Sample

We obtain data on tender offers from the Thomson Financial - Securities Data Corporation (SDC) Merger and Acquisitions Database - and select deals with a value of $10 million or above in which the target companies are US-based corporations. We exclude self-tender offers, deals with no change in control, and observations for which we are not able to obtain the New York Stock Exchange Trade and Quote (TAQ) data. Most hostile offers are either all-cash offers or include a large cash component; therefore, to avoid a bias toward friendly takeovers in our sample, we exclude transactions which have no cash component. Our dataset covers the period from 1993, the first year for which the TAQ data are available, to 2006. In total, we obtain data for 703 tender offers, including 596 friendly completed, 32 hostile completed, 20 friendly withdrawn and 55 hostile withdrawn transactions. Composition of our sample and selected characteristics for various types of deals included in our dataset are presented in table 4.1.

We examine investors' trading behaviour over a period of up to three weeks prior to and after the announcement date. Intense buying and selling takes place in

the period etending from one week prior to announcement to two weeks after the announcement. In weeks three and four before and after the event date, trading activity is lower and order imbalances are less informative, so we limit our study to [-3 weeks; +3 weeks] window around the tender offer announcement.

4.3.2. Imbalances

4.3.2.1. Measures of Order Imbalances and Selling Pressure

We use imbalances calculated at daily frequencies using the Lee-Ready (1991) algorithm in our tests. Following Barclay and Warner (1993), we define small trades as trades of 100 to 499 shares, medium trades as trades of 500 to 9,999 shares, and large trades as those of 10,000 shares or more. We exclude from our analysis opening trades, which accumulate all orders since the previous close executed simultaneously by a specialist who sets one price to clear the market. We remove quotes with negative bid-ask spreads and quotes for which either the ask or the bid price moves by more than 50 percent. Quotes lag the trade price by at least five seconds. A trade is classified as a buy if: a) the price is closer to the ask quote; b) if the price is higher than the price of the previous deal when the transaction is executed at the quote midpoint.

For each stock, we calculate order imbalances in transactions, the number of shares traded and dollar volume as a difference between buyer-initiated trades and seller-initiated trades normalized by total number of transactions, total number of shares traded and dollar volume. Measures of buying pressure based on the number of shares traded and dollar volume are almost identical, so we will report

results for order imbalances based on the number of trades and the share volume (results for measures based on dollar volume are available upon request). We aggregate daily imbalances over different periods by: 1) adding up buy and sell trades for the whole period; 2) taking an average of daily imbalances for each period.

In addition, we estimate scaled measures of selling pressure in large-, medium- and small-size trades as difference between number of shares acquired and sold divided by the number of shares in free float, for which we obtain data from CRSP.

4.3.2.2. Measurement Issues

We break down the total number of trades and shares traded by size of trade for several time periods and report the results in table 4.2. We observe that small trades account for 58 percent of all transactions, but only 8 percent of all shares traded in the [-3 week; +3 week] window. Over the same period, large trades account for three percent of total trades and 43 percent of share volume.

We employ weekly order imbalances based on averages of daily measures to mitigate follow-up effects in order imbalances. To illustrate our point, we report order imbalances on a daily basis for medium-size and small-size trades for the last week preceding the announcement in table 4.3. We observe that small-size trades follow medium-size trades, both in terms of direction and magnitude. If we sum up imbalances on a weekly basis, the mean for order imbalances in small-size trades becomes positive and statistically significant. However, if we calculate an

average of daily order imbalances, we obtain measures of buying power that are less affected by the follow-up effect. In our regression models, we employ measures based on averages of daily imbalances. We use cumulative measures of order imbalances to perform robustness checks.

4.3.3. Managerial Resistance

Hoffmeister et al (1981) report that managerial attitude is the single most important factor that determines a tender offer outcome. Walkling (1985) confirms this result by developing a logistic model that predicts tender offer success. We use an indicator variable equal to one to code tender offers with friendly managerial attitude and zero otherwise.

4.3.4. Bid Premium Size

The premium for corporate control is the major incentive for target firm shareholders to tender their shares to the bidder. If bidders face an upward-sloping supply curve of shares, the probability of the tender offer success will depend on the premium size. Hirshleifer and Titman (1990) develop a theoretical model showing that the probability of an offer's success increases with the bid premium. Walkling (1985) provides supporting empirical evidence. We estimate the premium size as a percentage difference between the closing stock price on the event date and the closing price on the previous business day and as a difference between the closing price on the event date and the market price one month prior to the announcement.

4.3.5. Percentage of Shares Owned and/or Controlled by the Bidder

The Williams Act (1968) requires the owner of a five percent stake to disclose ownership within ten days of the acquisition. After filing the original 13D Schedule, the acquiror should reveal any material changes, including a change in intent from "passive investor" to "investor seeking control." We obtain data on ownership of the bidder in the target firm - foothold - from the Securities and Exchange Commission filings.

However, foothold, or direct ownership, is not always equal to the portion of ownership that the bidder has over the target firm. Significant shareholders in target companies often engage in share voting agreements, which allow the bidder to vote shares owned by the significant shareholders in favor of the tender offer. Sometimes, target companies grant the bidder an option to purchase additional shares, effectively increasing the bidder's control over the target firm. The percentage of shares controlled by the acquiror in the target can be larger than the foothold and may give the buyer a controlling stake in the company until expiration of the tender offer. We code control of five percent, ten percent, and twenty-five percent and above using indicator variables. We set these dummies equal to one as soon as information about control is made public through S.E.C. filings. Average values for foothold holdings prior to the announcement are below five percent for all types of deals, but control over the target by the end of the third week after the announcement is larger for friendly deals. In friendly completed deals, acquirors on average control 17 percent of the target by the end of the third week after announcement (see table 4.1).

4.3.6. Renegotiation of Initial Tender Offer Terms

In our sample of 703 tender offers, 93 are being renegotiated in favor of the seller before the offer is completed or rejected, including 29 out of 32 hostile completed offers and 20 out of 55 hostile withdrawn offers. We set the renegotiation indicator variable equal to one in week one if the acquiror announces better terms of offer or a willingness to renegotiate initial terms in the first week after the announcement. As more announcements are made in weeks two and three, we code more deals as being renegotiated. By the end of week 3, 36 acquiring companies have announced their decision to renegotiate.

4.3.7. Stock Returns and Other Measures of Market Activity

All stock returns are adjusted using on the NYSE/AMEX/Nasdaq value-weighted index obtained from the Center for Research in Security Prices (CRSP). The volume of trading is calculated as the number of shares traded over a given period of time, normalized by the number of shares in free float, for which data are obtained from the CRSP. We also calculated measures of net purchases in small-, medium- and large-size trades by dividing net purchases of shares over a period of time by the number of shares in free float.

Excluding the initial reaction, which is often observed on the day following the announcement, we observe no price changes in the first three weeks for all categories of deals. Aggregation of returns and order imbalances in the first two days does not impact results that we report in the remainder of the paper.

4.3.8. News-adjusted Event Date

Following Jarrel and Poulsen (1989), we use the news-adjusted rather than the formal announcement date. The news-adjusted date, henceforth referred to as the event date, is the earlier of:

a. the public announcement of a tender offer;

b. the date of publication in the Dow Jones News Service about a tender offer announcement;

c. the date of filing of Schedule 14D-1, or tender offer proposal; or

d. the date of filing of Schedule 13D, which outlines the intention to seek a change in control.

In the remainder of the paper, we will refer to the news-adjusted announcement date as the announcement date.

4.4. Results

4.4.1. Pairwise Comparison of Order Imbalance Measures

Our findings shed light on the strategic behaviour of informed investors in tender offers. We carry out three tests to examine differences between medium-size trades, which have been shown to be linked to informed traders, and small-size and large-size trades.

First, we perform pairwise comparisons of order imbalances in medium-, small- and large-size trades on the announcement day and in each of the three weeks around the news-adjusted announcement day. In weeks 2 and 3 prior to the announcement, order imbalances in all trades are negative or not different from

zero across all types of deals (see table 4.4a). On the event day, order imbalances assume a negative sign, but the magnitude of sales is much smaller in hostile tender offers. Following the announcement, we observe heavy selling in small-size trades in all categories of deals. In large deals, order imbalances become negative in the three weeks following the announcement in completed deals. Pairwise t-statistics for difference in means for order imbalances in different trade sizes are reported in table 4.4b.

A comparison of medium-size trades across various categories of deals reveals three patterns: first, order imbalances attain a positive sign in the last week prior to the announcement in friendly deals; second, selling is much heavier in friendly deals on the announcement day; third, selling pressure is larger after the announcement in to-be-completed deals. The pairwise t-tests for the mean values of medium-size trades are reported in table 4.5, allowing to compare selling pressure in informed trades by attitude and deal outcome.

We make a preliminary conclusion that there is information leakage in friendly deals, as evidenced by accumulations of stock in week 1 prior to the announcements and larger order imbalances in medium-size trades in completed deals on the event day. Following the announcement, selling pressure in medium-size trades is larger in completed deals. We conclude that medium-size trades carry more information, both about management attitude – hostile or friendly – prior to the announcement and about deal completion after its announcement. We put these conclusions to further tests in multivariate models in the remainder of this section.

4.4.2. Order Imbalances, Price Changes and Managerial Attitude

Our second test examines whether buying pressure is associated with knowledge about managerial attitude around the announcement date. The results of regression models reported in table 4.6 suggest that the direction of medium-size trades is associated with the type of deal – friendly or hostile – both prior and after the announcement[37]. We observe accumulations of stock in friendly tender offers in week 1 prior to the announcement and sales on the announcement day and each of the three weeks following the event date. Small-size trades, however, are unrelated to the deal type until after the announcement day, suggesting that small-size traders are not informed. We observe that selling in medium-size trades after the announcement is more heavily influenced by deal type than is selling in small-size trades. Also, the intercepts in regressions with small-size trades assume large and negative signs in line with the results reported in the previous section. Selling in small-size trades is heavy across all categories of deals, reflecting profit-taking by uninformed investors and the decision to sell shares to avoid the fixed costs of tendering.

Table 4.7 reports regression models with order imbalances based on the number of shares traded in each time period in small-, medium- and large-size trades. It follows that large-size traders either are uninformed or do not trade to avoid disclosure of private information they possess prior to the announcement date. One piece of evidence provides support for the argument that large traders

[37] We drop foothold and control variables from regressions reported in tables 4.6-4.8 because these do not attain significance in any of the considered specifications and do not affect the results. We use a premium based on the price one month prior to the announcement because this control variable has a lower p-value even though it is not significant in our models. We leave it in to make our specification more comparable with the logistic model of Walkling (1985).

prefer to avoid disclosure and that they are, in fact, informed. Compared to small-size trades, large-size trades assume a negative and significant coefficient on the event day, suggesting that large traders react faster to the tender offer announcement. Rapid reaction is observed because informed investors do not have an incentive to camouflage their trades after the official announcement is made.

We examine the motivation for informed traders to buy and sell shares around the announcement date. We calculate the market value of shares accumulated in the three-week pre-announcement period and the absolute gain based on the closing announcement day price in friendly deals, in which net stock purchases were positive. Stock accumulation in medium-size trades in the pre-announcement period is observed in 64 percent of friendly deals compared to 45 percent of hostile and unsolicited deals.[38] In absolute terms, medium-size traders accumulate $1.02 billion in stock for a total gain of $193 million, or an average of $0.3 million per tender offer. For example, when Credit Suisse First Boston acquired Donaldson, Lufkin and Jenrette in 2000, net purchases by medium-size traders in the three-week pre-announcement period amounted to $68 million for a gain of almost $25 million, based on the announcement-day closing price. The total value of the deal amounted to $11.5 billion. Clearly, informed investors have sufficient incentive to camouflage their trades both prior to and after the announcement.

[38] We observe abnormal positive stock returns in 67 percent of friendly deals and in 52 percent of hostile deals over the same period.

In summary, we conclude that the direction of medium-size trades reflects prior knowledge about upcoming announcements of friendly deals: informed investors accumulate stock prior to such an announcement and sell it afterwards. Figure 4.1 supports such an interpretation: we observe a spike in buying in friendly deals prior to the announcement and heavy selling in medium-size trades after the announcement. Large- and small-size trades do not reveal knowledge of private information prior to the announcement. We observe a spike in buying prior to the announcement in small-size trades in Figure 4.2, but the spike in the graph that shows pre-announcement buying is smaller. From our earlier discussion in section 4.3.2.2 and results reported in table 4.3, we know that small-size trades follow medium-size trades with a lag. Small-size trades exhibit late reactions to the announcement, suggesting that small-size traders are in fact uninformed. Figure 4.3 tracks changes in order imbalances in large-size trades. It support previously reported results – there is no distinct pattern in this category of trades prior to the announcement.

Figures 4.4-4.6 describe how scaled selling pressure measure changes around the announcement. Figure 4.5 clearly shows that small-size traders are uninformed as there is practically no difference in trading pattern in hostile and friendly deals. We observe a spike in buying in medium-size trades in Figure 4.4, but not in large-size trades in Figure 4.6.

Both in figures that illustrate order imbalances and scaled measures of selling pressure we observe large selling in medium-size and large-size trades. We

proceed to examine which trades convey information about the deal outcome in our next section.

4.4.3. Imbalances and Deal Outcome

If informed investors behave strategically, we should be able to infer the outcome of the proposed tender offer from the direction of their trades. We employ average order imbalances in the second and the third week after the announcement[39] in logistic models predicting the tender offer outcome. We omit week 1 from our analysis because measurements of buying pressure immediately following the announcement are noisy, especially in hostile deals, in which the initial reaction does not convey a lot of information about the deal outcome because the tender offer announcement appears to be unexpected. We report results for logistic regression models in Panel A of table 4.8. We eliminate observations for which medium-size and small-size order imbalances are missing, to perform comparisons of predictive power of small-size and medium-size trades in samples of equal or comparable size (models 1, 2, 4, 6, 7, 8, 10, 12). We observe that coefficients of medium-size trades have larger statistical significance and models with medium-size trades have marginally higher predictive power. Next, we test how all three measures – imbalances in small-, medium- and large-size trades perform in one regression model. We eliminate observations with missing medium- and small-size trades in models 4 and 10 and observations with missing large-size trades in models 5 and 11. We observe that coefficient of

[39] Since there is no leakage of information in hostile deals and there is an accumulation of stock in both withdrawn and completed friendly tender offers, we can not employ order imbalances prior to the announcement date to predict the deal outcome.

medium-size trades is the only measure of order imbalances in three models out of four (models 4, 10 and 11) and that it is insignificant only in one model (model 5). We conclude that informed trades are concentrated in medium-size category.

Next, we repeat our analysis using scaled measures of selling pressure in panel B of table 4.8. Results, although less conclusive, point in the same direction – medium-size trades contain more information about the deal outcome than trades in other categories. We conclude that informed traders spread their trades in the post-announcement period.

However, order imbalances only marginally increase the predictive power of the models. All model specifications, for instance, have a low ability to distinguish friendly withdrawn deals from friendly completed deals. At best, only one of the friendly rejected deals is correctly predicted[40]. To some extent, this low predictive ability is due to regulatory or reputational effects – 8 out of 20 friendly withdrawn deals are not completed due to the failure to obtain the permission of anti-trust bodies or unexpected fraud investigations in target companies. In a similar fashion, most of the incorrectly predicted hostile deals are completed deals[41]. Results improve substantially if we incorporate information about deal

[40] Walkling's (1985) model performs better in the estimation sample, but correctly predicts the outcome of only one out of seven friendly withdrawn offers in the validation sample. Our models have the same predictive power in estimation and validation samples, which we obtain by separating the original sample into two subsamples using either alphabetic ordering of trading symbols or odd-even number of observations.

[41] Since tender offer outcomes are so affected by managerial attitude, and such attitude is known upon announcement, we separate friendly deals from hostile and test the predictive power of imbalances based on medium-size trades. The predictive power does not improve in the friendly deals' subsample, but the number of correctly predicted hostile deals increases compared to the models reported in this study. Also, order imbalances based on medium-size trades perform better relative to imbalances based on small- and large-size trades, correctly predicting the outcome of larger number of tender offers. The renegotiation dummy and volume variable attain significance at the 5 percent level.

renegotiation, including renegotiation announcements that are beyond our event window. In addition, predictions for hostile deals could be affected by the free-rider problem among informed traders. Hirshleifer and Titman (1990) note that hostile tender offers are more subject to free-rider problems among shareholders, who may share fully in the improvements brought in by a successful takeover without tendering their shares. Also, if informed traders know that major shareholders will not tender shares and are unwilling to give up control over the firm themselves, they might still prefer to sell shares to avoid decline in share price after the offer is withdrawn.

One possible explanation for low predictive power of order imbalance variables based on medium-size trades is that the number of shares that exchange hands in the post-announcement period in medium-size trades is relatively small and does not lead to change in control. We calculate the net purchases of stock normalized by the number of shares in free float for all types of transactions and all types of deals and report these results in table 4.9. We observe that only 0.3 percent of the free float is accumulated in medium-size trades in three weeks prior to the announcement. Following the announcement, a total of 3.7 percent of the free float is sold in medium-size trades in friendly completed deals.

To confirm our results that informed traders buy shares prior to the announcement and sell them after the announcement in friendly deals, we employ one more set of regression models. We regress order imbalances and scaled measures of selling pressure on the event date and in weeks 1-3 on imbalances and scaled measures of selling pressure in the last week prior to the

announcement. We put to test metrics of medium-size trades in a sample of friendly completed deals. Results reported in table 4.10 provide some evidence that buyers in medium-size trades before the announcement turn into sellers after the tender offer announcement as evidenced by negative coefficient on measures of selling pressure.[42]

The evidence presented in this section confirms that informed investors behave strategically, accumulating stock in friendly tender offers prior to the deal announcement in medium-size trades. Following the announcement, sales of stock by informed investors are associated with a successful completion of the tender offers. Prior to the announcement, the direction of small-size trades is largely explained by price movements. Following the deal announcement and the price increase around the event date, uninformed investors sell stock in all deals. Large-size trades are less informative than medium-size trades even in the post-announcement period, when informed investors have lower incentives to camouflage their trades.

Our results lend support to stealth trading hypothesis versus public information hypothesis. Our empirical findings suggest that an analysis of order imbalances in medium-size trades around the tender offer announcements allows uninformed investors and market regulators to make inferences about the strategic behaviour of informed traders. Such an analysis can increase the speed of

[42] It may be the case that informed traders who accumulate stock prior to the event date, do not sell it after the event date, but tender it. This would explain why we obtain only partial evidence that buyers of stock in medium-size trades before the announcement turn into sellers after the announcement.

incorporation of new information into stock prices. At the same time, it may warrant additional regulation of trading activites of informed investors.

4.5. Conclusions

The primary objectives of this study are to investigate whether informed traders behave strategically during tender offer announcements and to find what private information can be inferred from informed investors' trading patterns.

We analyze 703 tender offers announced over the period 1993 through 2006. We find evidence that the behaviour of informed investors differs from that of the uninformed in the pre-announcement period and after the tender offer announcement. We confirm that informed investors break up large deals into medium-size trades, camouflaging their trades in both the pre-announcement and post-announcement periods. This result lends further support to the stealth trading hypothesis as opposed to the public information hypothesis.

Our findings can be summarized as follows. First, we document that informed traders accumulate stock in the pre-announcement period in a large number of friendly deals in anticipation of a takeover premium. Second, we document that the larger selling pressure in informed trades is associated with higher probability of a successful deal completion. Our results link informed trading around tender offer announcement dates with private information available to insiders and allow uninformed investors to expand their information set, thus increasing the speed of adjustment of stock prices to new information and market efficiency. Finally, our

findings call into question the effectiveness of disclosure mechanisms of trading by informed investors.

4.6. References

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Table 4.1.: Selected Data for Tender Offers by Target Firm Management Attitude and Deal Outcome

The table presents means for various characteristics of 703 tender offers by type - friendly or hostile - and completion. Foothold represents the percentage of shares owned by the bidder prior to the launch of the tender offer. Control over target shows the percentage of shares that the bidder is entitled to vote in favor of the tender offer under various arrangements, including acquisition of shares in the open market, extension of option on purchase of extra shares by incumbent management and agreement of the board to vote shares owned by insiders. Premium equals percentage difference between offer price and market price on the last trading day before the tender offer announcement or between the offer price and the price one month prior to the announcement. All stock returns are adjusted for the return of Center for Research in Security Prices NYSE/AMEX/Nasdaq value-weighted index for the corresponding period. Trading volume is calculated as number of all shares traded over the corresponding period, normalized by the total number of shares in free float. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Friendly completed	Hostile completed	Friendly withdrawn	Hostile withdrawn
Number of observations	596	32	20	55
Foothold	2.1%***	3.4%**	1.4%***	4.1%***
Control over target by the end of third week after announcement	17.3%***	4.0%**	9.3%***	6.2%***
Premium based on price one day before announcement	40.0%***	46.6%***	46.3%***	39.5%***
Premium based on price one month before announcement	52.6%***	45.2%***	67.2%***	38.5%***
Stock return in week 3 prior to event	1.8%***	-0.9%	5.0%	-0.6%
Stock return in week 2 prior to event	2.2%***	-0.6%	2.1%	1.1%
Stock return in week 1 prior to event	4.6%***	1.2%	9.1%	1.5%
Stock return on event day	23.1%***	19.1%***	12.78%***	19.0%***
Stock return in week 1 after event	6.0%***	16.5%***	14.35%***	8.1%***
Stock return in week 2 after event	0.1%	1.4%	1.1%	-0.2%
Stock return in week 3 after event	0.0%	1.2%	0.5%	-1.0%
Time from announcement to completion in business days	49***	108***	76***	88***
Return from announcement until deal withdrawal/completion	5.6%***	20.2%***	-12.9%	6.5%
Volume in three weeks prior to announcement	7.7%***	10.15%***	10.0%***	7.9%***
Volume on announcement day	10.7%***	11.5%***	7.6%***	7.0%***
Volume over three weeks after announcement	20.3%***	34.3%***	27.6%***	22.1%***

Table 4.2.: Breakdown of Trades by Size Based on Number of Trades and Trading Volume

Breakdown of the number of trades and the number of shares traded in small-, medium- and large-size trades over different time periods around the announcement date. Small-size trades are trades of 100-499 shares, medium-size trades are trades of 500-9,999 shares and large-size trades are trades of above 10,000 shares. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Percentage of small-size trades	Percentage of medium-size trades	Percentage of large-size trades	Percentage of shares traded in small-size trades	Percentage of shares traded in medium-size trades	Percentage of shares traded in large-size trades
Week 3 before announcement	64%	35%	1%	13%	59%	28%
Week 2 before announcement	62%	38%	1%	12%	60%	27%
Week 1 before announcement	61%	38%	1%	12%	60%	28%
Event day	49%	46%	4%	5%	43%	53%
Week 1 after announcement	55%	41%	4%	6%	44%	50%
Week 2 after announcement	60%	37%	3%	8%	47%	45%
Week 3 after announcement	62%	35%	3%	8%	45%	47%
Total	58%	39%	3%	8%	49%	43%

Table 4.3.: Order Imbalances in the Last Week Prior to Tender Offer Announcement in Uncontested (Friendly) Tender Offers

The table provides daily average order imbalances in medium-size and small-size trades. Imbalances are based on the number of transactions and the number of shares traded. We report means for trades five days prior to deal announcement for a subsample of friendly tender offers. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

Trading day prior to event date	Imbalances based on number of traded shares		Imbalances based on number of transactions	
	Medium-size trades	Small-sized trades	Medium-size trades	Small-sized trades
Day -5	0.038*	0.010	0.042**	-0.001
Day -4	-0.016	-0.014	-0.010	-0.027
Day -3	0.043**	-0.008	0.052**	-0.019
Day -2	0.085***	0.052**	0.087***	0.040*
Day -1	0.154***	0.119***	0.154***	0.106***

Table 4.4a: Comparison of Order Imbalances in Trades of Different Size around the Event Date

The table provides comparisons of means in order imbalances based on the average number of trades in large-size, medium-size and small-size transactions by type of deal - friendly completed, friendly withdrawn, hostile completed and hostile withdrawn. Panel A of the table includes number of observations for each trade size and mean for type of deal. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Friendly completed tender offers						Hostile completed tender offers					
	N	Small trades	N	Medium Trades	N	Large trades	N	Small trades	N	Medium Trades	N	Large trades
3 weeks prior to event	584	-0.053***	586	-0.037***	352	-0.049	30	-0.052	30	-0.080	26	0.015
2 weeks prior to event	583	-0.031**	588	-0.007	347	-0.071**	28	-0.097	29	-0.127**	25	-0.132
1 week prior to event	586	0.015	588	0.069***	361	-0.064*	32	-0.175**	32	-0.089	26	-0.172*
Event day	591	-0.251***	593	-0.269***	480	-0.253***	32	-0.278***	31	-0.090*	29	-0.144
1 week after event	589	-0.416***	591	-0.382***	548	-0.279***	32	-0.370***	32	-0.186***	32	-0.201**
2 weeks after event	577	-0.450***	580	-0.375***	492	-0.290***	32	-0.424***	32	-0.280***	29	-0.099
3 weeks after event	561	-0.452***	565	-0.373***	446	-0.328***	32	-0.401***	32	-0.273***	28	-0.186***
	Friendly withdrawn tender offers						Hostile withdrawn tender offers					
	N	Small trades	N	Medium Trades	N	Large trades	N	Small trades	N	Medium Trades	N	Large trades
3 weeks prior to event	20	-0.119	20	-0.070	15	0.074	52	-0.045	54	-0.123***	43	-0.099
2 weeks prior to event	19	-0.029	20	-0.031	15	0.094	54	-0.067	55	-0.005	39	-0.138
1 week prior to event	20	-0.022	20	0.029	14	-0.228	54	0.020	55	-0.025	43	-0.075
Event day	20	-0.091	20	-0.182*	15	-0.052	50	-0.141**	55	-0.056	41	0.043
1 week after event	20	-0.319***	20	-0.224***	17	-0.173	54	-0.285***	54	-0.167***	48	-0.068
2 weeks after event	19	-0.462***	19	-0.298***	17	-0.206	53	-0.217***	53	-0.115***	47	-0.077
3 weeks after event	19	-0.511***	19	-0.227***	18	-0.253*	54	-0.281***	54	-0.181***	45	-0.035

Table 4.4b: Comparison of Order Imbalances in Trades of Different Size around the Event Date

The table provides comparisons of means in order imbalances based on the average number of trades in large-size, medium-size and small-size transactions by type of deal - friendly completed, friendly withdrawn, hostile completed and hostile withdrawn. Panel B of the table includes pairwise t-tests for means between small-size trades and medium-size trades, between medium-size trades and large-size trades and between large-size trades and small-size trades. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Friendly completed tender offers			Hostile completed tender offers		
	T-test for means			T-test for means		
	Small trades vs medium trades	Medium trades vs large trades	Large trades vs small trades	Small trades vs medium trades	Medium trades vs large trades	Large trades vs small trades
3 weeks prior to event	0.75	0.32	0.10	0.32	0.70	-0.48
2 weeks prior to event	0.24	1.71*	1.06	0.36	0.05	0.29
1 week prior to event	2.72***	-3.73***	-2.18**	0.97	0.81	0.04
Event day	0.77	0.57	0.08	2.36**	0.51	1.24
1 week after event	1.97**	4.67***	6.02***	2.61**	0.16	1.62
2 weeks after event	3.80***	3.01***	5.67***	1.87*	2.32**	3.61***
3 weeks after event	3.78***	1.56	4.18***	1.87*	1.28	2.72***
	Friendly withdrawn tender offers			Hostile withdrawn tender offers		
	T-test for means			T-test for means		
	Small trades vs medium trades	Medium trades vs large trades	Large trades vs small trades	Small trades vs medium trades	Medium trades vs large trades	Large trades vs small trades
3 weeks prior to event	0.43	-0.75	-0.96	1.24	0.24	0.53
2 weeks prior to event	0.03	-0.59	-0.58	0.89	1.34	0.71
1 week prior to event	-0.56	-1.40	1.12	-0.78	0.60	-1.08
Event day	0.67	0.77	0.22	1.12	-1.10	-1.92*
1 week after event	0.97	0.36	1.07	2.11**	1.51	2.99***
2 weeks after event	1.72*	0.63	1.68	1.88*	0.48	-1.62
3 weeks after event	3.15***	0.18	1.88*	1.77*	2.16**	-3.34***

Table 4.5.: Comparison of Order Imbalances in Medium-Size Trades by Type of Deal

The table provides comparisons of order imbalances based on the average number of trades in medium-size transactions by type of deal - friendly completed, friendly withdrawn, hostile completed and hostile withdrawn. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Friendly completed tender offers	Hostile completed tender offers	T-tests for means
3 weeks prior to event	-0.037***	-0.080	0.70
2 weeks prior to event	-0.007	-0.127**	1.90*
1 week prior to event	0.069***	-0.089	2.73***
Event day	-0.269***	-0.090*	2.65***
1 week after event	-0.382***	-0.186***	5.02***
2 weeks after event	-0.375***	-0.280***	1.69*
3 weeks after event	-0.373***	-0.273***	2.34**
	Friendly withdrawn tender offers	Hostile withdrawn tender offers	T-tests for means
3 weeks prior to event	-0.070	-0.123***	0.70
2 weeks prior to event	-0.031	-0.005	0.24
1 week prior to event	0.029	-0.025	0.81
Event day	-0.182*	-0.056	1.33
1 week after event	-0.224***	-0.167***	0.87
2 weeks after event	-0.298***	-0.115***	2.94***
3 weeks after event	-0.227***	-0.181***	0.68
	T-tests for means		
3 weeks prior to event	0.43	0.63	
2 weeks prior to event	0.31	1.52	
1 week prior to event	0.55	0.95	
Event day	1.03	0.44	
1 week after event	2.44**	0.43	
2 weeks after event	1.06	3.14***	
3 weeks after event	1.91*	1.74*	

Table 4.6.: Regression Models of Order Imbalances Based on Number of Trades

The table presents regression models with order imbalances based on average number of trades in different time periods around the announcement date as a dependent variable. Attitude represents the target company's attitude - friendly or hostile - toward the announced tender offer. Renegotiation is a dummy that represents publicly announced renegotiation of initial offer terms. All stock returns are adjusted for the return of Center for Research in Security Prices NYSE/AMEX/Nasdaq value-weighted index for corresponding period. Trading volume is calculated as a number of all shares traded over the corresponding period, normalized by the total number of shares in free float. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

a. Models with imbalances in small-size transactions as dependent variables

	Intercept	Attitude	Renegotiation	Stock return	Volume	Adj Rsq	N
Imbalances in week 3 prior to event	-0.05	-0.02		0.57***	0.31	0.0219	685
Imbalances in week 2 prior to event	-0.08**	0.04		0.50***	0.16	0.0208	683
Imbalances in week 1 prior to event	-0.08**	0.05		0.60***	0.47	0.0463	691
Imbalances on event date	-0.12**	-0.04		-0.05	-0.74***	0.0563	692
Imbalances in week 1 after the event	-0.33***	-0.09**	0.02	0.00	0.09	0.0052	694
Imbalances in week 2 after the event	-0.35***	-0.14***	0.04	0.32	0.68**	0.0320	680
Imbalances in week 3 after the event	-0.39***	-0.11***	-0.05	-0.53	1.20***	0.0310	665

Table 4.6 (continued)

b. Models with imbalances in medium-size transactions as dependent variables

	Intercept	Attitude	Renegotiation	Stock return	Volume	Adj Rsq	N
Imbalances in week 3 prior to event	-0.11***	0.05		0.67***	0.25	0.0463	689
Imbalances in week 2 prior to event	-0.04	0.03		0.75***	-0.23	0.0497	691
Imbalances in week 1 prior to event	-0.07***	0.10***		0.62***	0.25	0.0698	694
Imbalances on event date	0.01	-0.18***		-0.16***	-0.53***	0.0922	698
Imbalances in week 1 after the event	-0.21***	-0.19***	0.08	-0.07	0.24***	0.0597	696
Imbalances in week 2 after the event	-0.22***	-0.19***	-0.02	0.23	0.64***	0.0542	683
Imbalances in week 3 after the event	-0.27***	-0.13**	0.04	0.17	1.13***	0.0501	669

c. Models with imbalances in large-size transactions as dependent variables

	Intercept	Attitude	Renegotiation	Stock return	Volume	Adj Rsq	N
Imbalances in week 3 prior to event	-0.01	-0.03		1.14***	-0.95	0.0265	435
Imbalances in week 2 prior to event	-0.16*	0.06		0.40	0.60	0.0038	425
Imbalances in week 1 prior to event	-0.11	0.03		0.31	-0.20	-0.0019	443
Imbalances on event date	-0.01	-0.21***		-0.15**	0.04	0.0202	564
Imbalances in week 1 after the event	-0.21***	-0.09	0.09	-0.02	0.18	0.0125	644
Imbalances in week 2 after the event	-0.16*	-0.13	0.10	0.41	0.04	0.0147	584
Imbalances in week 3 after the event	-0.17*	-0.19**	0.04	0.10	0.70	0.0223	536

Table 4.7.: Regression Models of Order Imbalances Based on Share Volume

The table presents regression models with order imbalances based on cumulative number of traded shares in different time periods around the announcement date as a dependent variable. Attitude represents the target company's attitude - friendly or hostile - toward the announced tender offer. Renegotiation is a dummy that represents publicly announced renegotiation of initial offer terms. All stock returns are adjusted for the return of Center for Research in Security Prices NYSE/AMEX/Nasdaq value-weighted index for corresponding period. Trading volume is calculated as a number of all shares traded over the corresponding period, normalized by the total number of shares in free float. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

a. Models with imbalances in small-size transactions as dependent variables

	Intercept	Attitude	Renegotiation	Stock return	Volume	Adj Rsq	N
Imbalances in week 3 prior to event	-0.01	-0.04		0.72***	0.08	0.0325	685
Imbalances in week 2 prior to event	-0.07*	0.04		0.57***	0.16	0.0266	683
Imbalances in week 1 prior to event	-0.08**	0.09**		0.56***	0.38	0.0437	691
Imbalances on event date	-0.12**	-0.05		-0.07	-0.76***	0.0606	692
Imbalances in week 1 after the event	-0.37***	-0.05	0.09**	0.01	0.07	0.0143	694
Imbalances in week 2 after the event	-0.36***	-0.12***	0.05	0.18	0.63**	0.0288	680
Imbalances in week 3 after the event	-0.46***	-0.02	0.13**	-0.52	1.01***	0.0330	665

Table 4.7 (continued)

b. Models with imbalances in medium-size transactions as dependent variables

	Intercept	Attitude	Renegotiation	Stock return	Volume	Adj Rsq	N
Imbalances in week 3 prior to event	-0.08***	0.04		0.88***	0.12	0.0656	689
Imbalances in week 2 prior to event	0.02	-0.01		0.83***	-0.55	0.0553	691
Imbalances in week 1 prior to event	-0.04	0.08**		0.64***	0.29	0.0695	694
Imbalances on event date	0.02	-0.20***		-0.15***	-0.36***	0.0660	698
Imbalances in week 1 after the event	-0.24***	-0.13***	0.11**	-0.07	0.31***	0.0718	696
Imbalances in week 2 after the event	-0.15***	-0.18***	0.02	0.11	0.36	0.0402	683
Imbalances in week 3 after the event	-0.24***	-0.12**	0.05	0.20	0.86***	0.0409	669

c. Models with imbalances in large-size transactions as dependent variables

	Intercept	Attitude	Renegotiation	Stock return	Volume	Adj Rsq	N
Imbalances in week 3 prior to event	-0.03	0.00		0.94***	-0.84	0.0261	692
Imbalances in week 2 prior to event	-0.13**	0.07		0.33*	0.15	0.0032	695
Imbalances in week 1 prior to event	-0.02	-0.03		0.29*	-0.40	0.0009	697
Imbalances on event date	-0.01	-0.14***		-0.21***	-0.17	0.0280	702
Imbalances in week 1 after the event	-0.17***	-0.13**	0.05	0.03	-0.06	0.0104	697
Imbalances in week 2 after the event	-0.12	-0.12*	0.05	0.54	-0.78**	0.0095	687
Imbalances in week 3 after the event	-0.13*	-0.16**	0.05	0.12	-0.56	0.0127	671

Table 4.8a: Logistic Models Predicting Probability of Merger Completion

The table presents logistic models that predict the outcome of announced tender offers. Panel A of the table presents models that employ order imbalances as measures of selling pressure. Order imbalances are based on average number of trades for each period. The dependent variable equals one if a tender offer is completed and zero if it is rejected. Renegotiation equals one if the target company renegotiates initial offer terms. Premium equals the percentage difference between offer price and price one month prior to announcement date. All stock returns are calculated as the returns of Center for Research in Security Prices NYSE/AMEX/Nasdaq value-weighted index for the corresponding period. Volume equals the number of shares traded over the period normalized by total number of shares in free float. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Measures of selling pressure in week 2 after event date (models 1-6)						Measures of selling pressure in week 3 after event date (models 6-12)					
	1	2	3	4	5	6	7	8	9	10	11	12
Intercept	-1.02**	-1.06***	-0.78***	-1.14***	-1.20***	-0.75**	-0.80*	-1.08***	-0.78*	-1.16***	-0.88*	-0.74*
Imb. in small-size trades	-0.93**			-0.40	-0.66		-0.21			0.28	0.91	
Imb. in medium-size trades		-1.63***		-1.39**	-0.95			-1.45**		-1.51**	-2.05***	
Imb. in large-size trades			-0.23	-0.02	-0.08				-0.53	-0.27	-0.34	
Attitude	4.14***	4.03***	4.09***	4.03***	3.99***	4.20***	4.26***	4.19***	3.89***	4.22***	3.93***	4.29***
Renegotiation	1.24**	1.16*	1.08*	1.19**	1.14*	1.20**	1.22**	1.14**	0.80	1.23**	0.71	1.24**
Premium	-0.35	-0.34	1.08*	-0.37	-0.32	-0.25	-0.33	-0.38	-0.18	-0.34	-0.25	-0.32
Stock returns	1.00	0.86	-0.22	0.99	0.57	0.54	2.70	3.33	2.32	-0.49	3.29	2.71
Volume	2.09	2.44	2.14	2.52	3.11	1.77	0.18	1.05	1.27	2.61	1.63	0.01
Likelihood ratio	187.08***	190.65***	157.91***	191.24***	162.31***	183.06***	187.38***	193.41***	144.19***	193.71***	150.90***	187.18***
Wald Chi-square	143.21***	140.63***	126.22***	140.24***	122.68***	145.81***	144.74***	140.31***	115.31***	140.21***	111.27***	144.80***
Number of obs.	677	677	585	677	585	677	664	664	537	664	536	664
Completed deals	605	605	521	605	521	605	591	591	474	591	473	591
Rejected deals	72	72	64	72	64	72	73	73	63	73	63	73
N. of incorrectly predicted friendly deals	19	19	17	19	17	19	19	19	18	19	18	19
N. of incorrectly predicted hostile deals	25	24	25	25	21	27	27	23	23	25	22	27
Total number of incorrect predictions	44	43	42	44	38	46	46	42	41	44	40	46

Table 4.8b: Logistic Models Predicting Probability of Merger Completion

The table presents logistic model that predict the outcome of announced tender offers. Panel B of the table presents models that employ scaled net buys as measures of selling pressure. Scaled buys are calculated as the number of shares acquired in small-size, medium-size and large-size trades less the number of shares sold in trades of matching size divided by the number of sharer in free float. The dependent variable equals one if tender offer is completed and zero if it is rejected. Renegotiation equals one if the target company renegotiates initial offer terms. Premium equals the percentage difference between offer price and price one month prior to announcement date. All stock returns are calculated as the returns of Center for Research in Security Prices NYSE/AMEX/Nasdaq value-weighted index for the corresponding period. Volume equals the number of shares traded over the period normalized by the total number of shares in free float. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

	Measures of selling pressure in week 2 after event date (models 1-5)					Measures of selling pressure in week 3 after event date (models 6-10)				
	1	2	3	4	5	6	7	8	9	10
Intercept	-0.81**	-0.75**	-0.73***	-0.73*	-0.78**	-0.72*	-0.76*	-0.73*	-0.72*	-0.75*
Scaled net buys in small-size trades	-203.9**			-3.8	-64.2	58.1			219.8	264.8
Scaled net buys in medium-size trades		-64.5**		-60.3**	-50.2*		-37.4		-46.91	-48.6
Scaled net buys in large-size trades			-19.8	-12.8	-14.4			-21.5	-17.92	-20.8
Attitude	4.20***	4.12***	4.03***	4.07***	3.97***	4.30***	4.25***	3.96***	4.26***	4.00***
Renegotiation	1.21**	1.21**	0.96	1.15*	1.00	1.26**	1.18**	0.67	1.12**	0.62
Premium	-0.31	-0.37	-0.20	-0.34	-0.27	-0.31	-0.37	-0.23	-0.36	-0.26
Stock returns	0.43	0.68	0.09	0.67	0.11	2.66	3.54	2.07	3.52	3.21
Volume	1.40	-1.06	0.51	-2.06	-1.37	0.07	-0.97	-0.25	-2.34	0.59
Likelihood ratio	184.23***	189.94***	159.36***	190.68***	163.73***	187.29***	189.22***	145.10***	192.21***	147.94***
Wald Chi-square	144.83***	141.95***	124.83***	141.46***	123.04***	144.73***	143.09***	115.59***	141.52***	113.59***
Number of observations	677	677	585	677	585	664	664	537	664	536
Completed deals	605	605	521	605	521	591	591	474	591	473
Rejected deals	72	72	64	72	64	73	73	63	73	63
N. of incorrectly predicted friendly deals	19	19	17	19	17	19	19	18	19	17
N. of incorrectly predicted hostile deals	27	25	25	27	24	26	24	24	25	22
Total number of incorrect predictions	46	44	42	46	44	45	43	42	44	39

Table 4.9.: Percentage of Free Float Acquired or Sold in Trades of Different Size around Tender Offer Announcements

The table presents net purchases of stock normalized by the number of shares in free float over three weeks prior to a deal announcement, on the day of announcement and over three weeks after deal announcement by type of deal - friendly completed, hostile completed, friendly withdrawn and hostile withdrawn and for trades of different sizes. ***,**,* represent significance at 1%, 5% and 10% levels, respectively.

Type of tender offer	Friendly completed	Hostile completed	Friendly withdrawn	Hostile withdrawn
Number of observations	596	32	20	55
Net purchases of stock in 3 weeks prior to announcement in small trades	0.03%***	-0.0%	0.1%	0.0%
Net purchases of stock in 3 weeks prior to announcement in medium trades	0.3%***	0.1%	0.3%	0.0%
Net purchases of stock in 3 weeks prior to announcement in large trades	-0.1%***	-0.4%	-0.1%	-0.0%
Net purchases of stock on announcement day in small trades	-0.1%***	-0.2%**	-0.0%***	-0.1%**
Net purchases of stock on announcement day in medium trades	-1.3%***	-0.3%	-1.0%**	-0.3%*
Net purchases of stock on announcement day in large trades	-1.9%***	-0.6%*	-1.4%	-0.1%
Net purchases of stock in 3 weeks after announcement in small trades	-0.3%***	-0.4%***	-0.3%**	-0.2%***
Net purchases of stock in 3 weeks after announcement in medium trades	-2.4%***	-2.1%***	-2.3%***	-0.9%***
Net purchases of stock in 3 weeks after announcement in large trades	-3.7%***	-3.1%***	-3.3%*	-1.4%***

Table 4.10.: Regression Models of Measures of Selling Pressure in Post-Announcement Period on Measures of Selling Pressure One Week Prior to Announcement in Medium-Size Trades in 596 Friendly Completed Tender Offers

Results are based on a subsample friendly completed tender offers. Panels A through E of the table present models with different measures of selling pressure. Panel A of the table presents models with order imbalances based on average number of trades. Panel B presents models with order imbalances based on average number of shares. Panel C presents models with order imbalances based on cumulative number of trades. Panel D presents models with order imbalances based on cumulative number of shares. Panel E presents models with scaled number of buys as measures of selling pressure. Scaled buys are calculated as the number of shares acquired in medium-size trades less the number of shares sold in medium-size trades divided by the number of sharer in free float. Renegotiation equals one if the target company renegotiates initial offer terms. Premium equals the percentage difference between offer price and price one month prior to the announcement date. All stock returns are calculated as the returns of Center for Research in Security Prices NYSE/AMEX/Nasdaq value-weighted index for the corresponding period. Volume equals the number of shares traded over the period normalized by total number of shares in free flo

	Intercept	Measure of selling pressure	Renegotiation	Premium	Stock Returns	Volume	Adj Rsq	N
A. Order imbalances based on trades								
Imbalances on the event date	-0.217***	0.055		0.107***	-0.230***	-0.554***	0.0812	585
Imbalances in week 1 after the event	-0.401***	0.003	-0.037	-0.020	-0.076	0.293***	0.0058	585
Imbalances in week 2 after the event	-0.385***	-0.040	0.024	-0.043	0.341	0.715**	0.0178	573
Imbalances in week 3 after the event	-0.387***	-0.020	0.020	-0.050	0.028	1.182***	0.0264	559
B. Order imbalances based on shares								
Imbalances on the event date	-0.221***	0.056		0.099**	-0.220***	-0.388***	0.0493	585
Imbalances in week 1 after the event	-0.381***	0.012	-0.029	0.008	-0.088	0.327***	0.0072	585
Imbalances in week 2 after the event	-0.361***	-0.060	0.026	-0.009	0.290	0.649**	0.0116	573
Imbalances in week 3 after the event	-0.350***	-0.040	0.005	-0.054*	0.172	1.031***	0.0201	559
C. Order imbalances based on trades								
Imbalances on the event date	-0.216***	0.033		0.107***	-0.231***	-0.555***	0.0798	585
Imbalances in week 1 after the event	-0.399***	-0.029	-0.080	-0.016	-0.058	0.337***	0.0105	585
Imbalances in week 2 after the event	-0.364***	-0.073*	0.057	-0.037	0.150	0.600**	0.0110	573
Imbalances in week 3 after the event	-0.382***	-0.037	0.049	-0.023	-0.018	1.113***	0.0212	559
D. Order imbalances based on shares								
Imbalances on the event date	-0.217***	0.005		0.100**	-0.222***	-0.388***	0.0472	585
Imbalances in week 1 after the event	-0.371***	-0.007	-0.042	0.003	-0.077	0.359***	0.0101	585
Imbalances in week 2 after the event	-0.343***	-0.112**	0.095	0.010	0.066	0.455	0.0102	573
Imbalances in week 3 after the event	-0.347***	-0.045	0.005	-0.025	0.139	0.955***	0.0115	559
E. Scaled net buys								
Scaled net buys on the event date	0.001	-0.179*		-0.004*	-0.002	-0.110***	0.4427	585
Scaled net buys in week 1 after the event	-0.003**	-0.117	0.002	-0.003*	-0.003	-0.079***	0.2230	585
Scaled net buys in week 2 after the event	-0.002**	-0.125**	0.001	-0.000	-0.003	-0.082***	0.2290	573
Scaled net buys in week 3 after the event	-0.001**	-0.093**	0.004**	-0.001	0.000	-0.067***	0.1876	559

Figure 4.1.: Order Imbalances in Medium-Sized Trades around the Announcement Date
Imbalances are based on daily average of number of medium-size trades for 616 friendly and 87 hostile deals in [-1 month;+1 month] window.

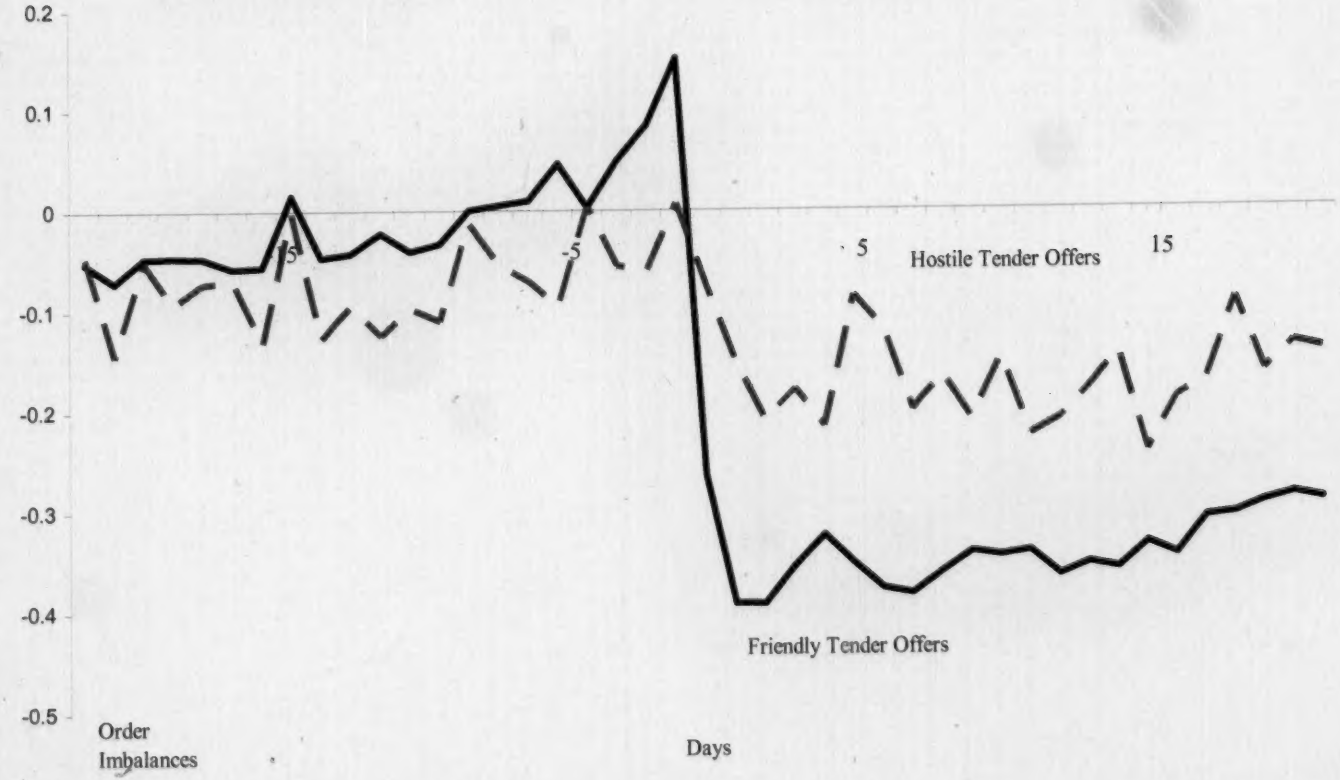


Figure 4.2.: Order Imbalances in Small-Sized Trades around the Announcement Date
Imbalances are based on daily average of number of small-size trades for 616 friendly and 87 hostile deals in [-1 month; +1 month] window.

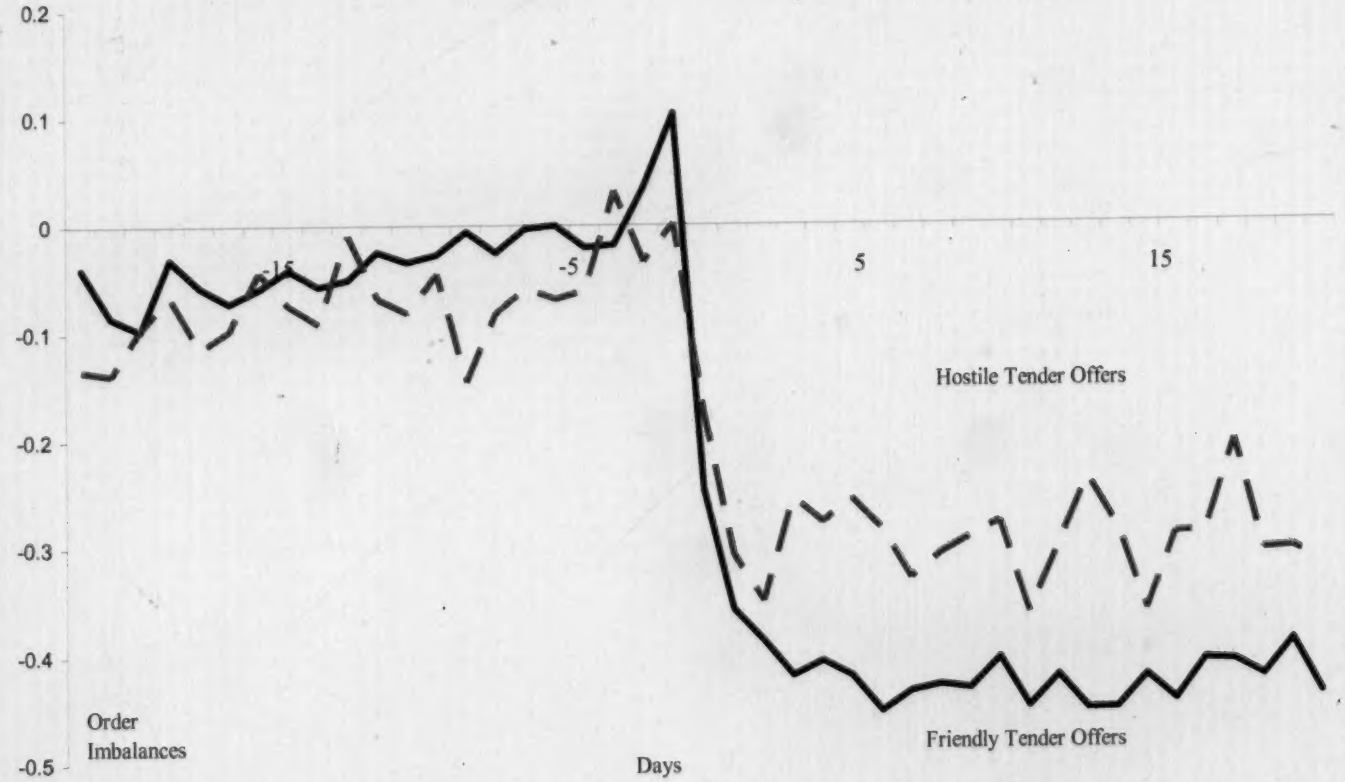


Figure 4.3.: Order Imbalances in Large-Sized Trades around the Announcement Date
Imbalances are based on daily average of number of medium-size trades for 616 friendly and 87 hostile deals in [-1 month; +1 month] window.

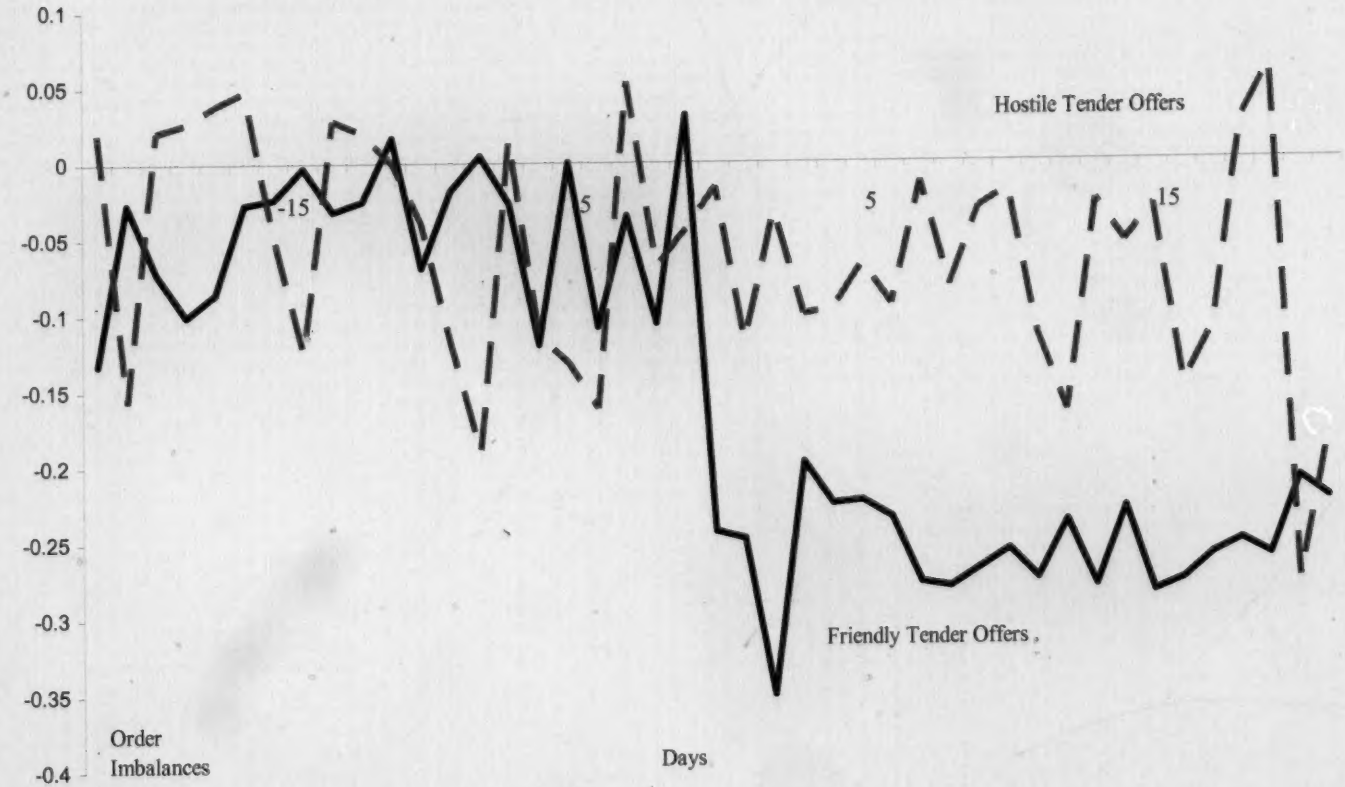


Figure 4.4.: Scaled Net Buys of Stock in Medium-Sized Trades around the Announcement Date

Net Buys are based on daily averages net buys of stock scaled by number of shares in free float for 616 friendly and 87 hostile dealsin [-1 month;+1 month] window.

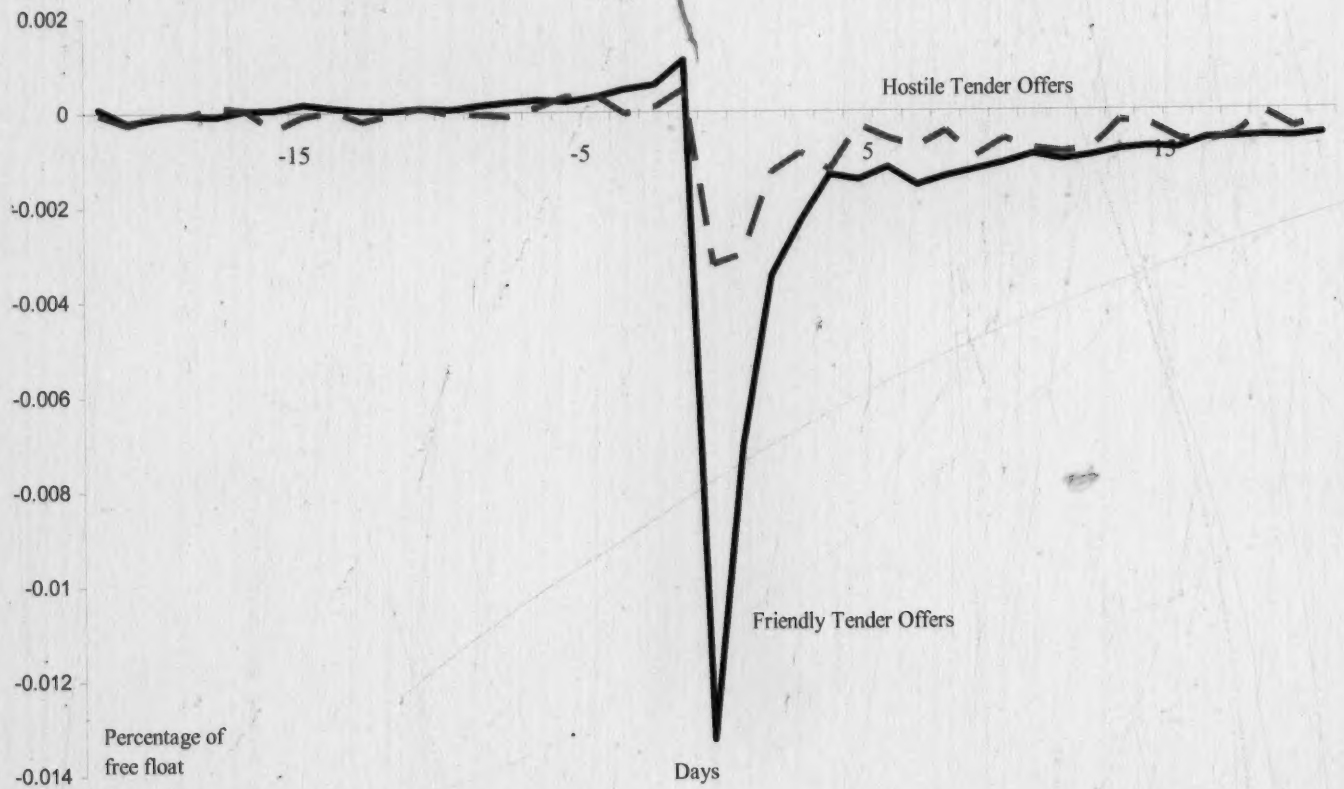


Figure 4.5.: Scaled Net Buys of Stock in Small-Sized Trades around the Announcement Date

Net Buys are based on daily averages net buys of stock scaled by number of shares in free float for 616 friendly and 87 hostile deals in [-1 month;+1 month] window.

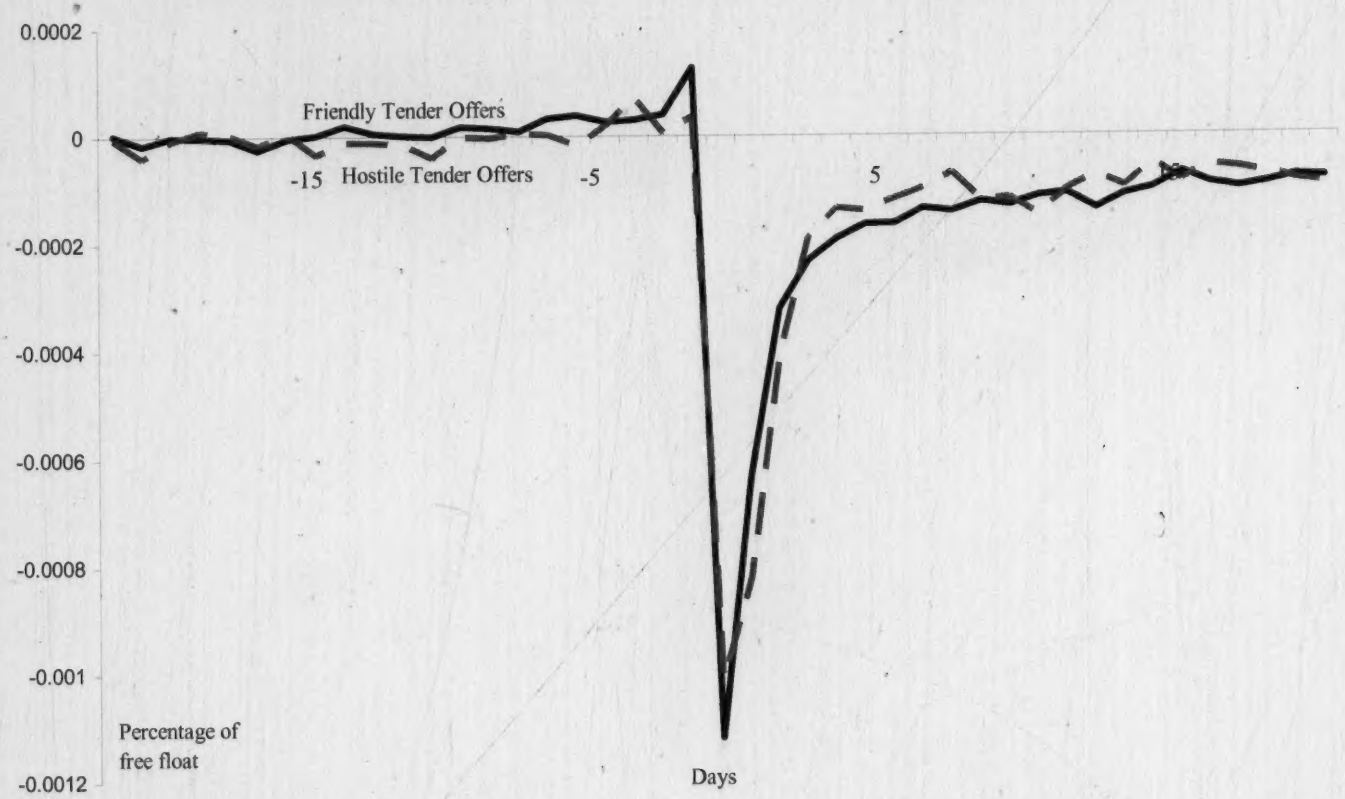
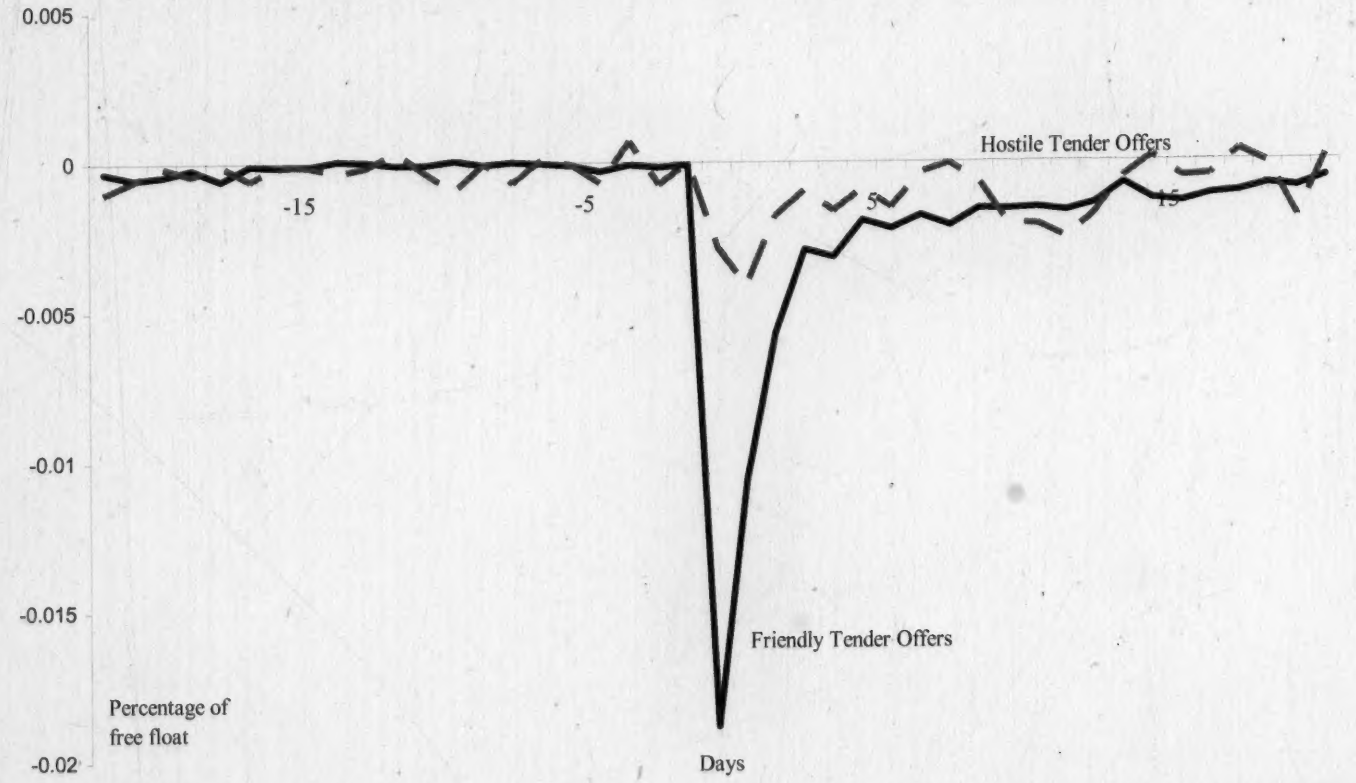


Figure 4.6.: Scaled Net Buys of Stock in Large-Sized Trades around the Announcement Date

Net Buys are based on daily averages net buys of stock scaled by number of shares in free float for 616 friendly and 87 hostile deals in [-1 month;+1 month] window.